THE DUKE IN A WARM CORNER.

THE GUN

AND ITS DEVELOPMENT;

WITH

Notes on Shooting.

BY

W. W. GREENER,

AUTHOR OF "MODERN BREECH-LOADERS," "CHOKE-BORE GUNS," &C.

Illustrated.

SECOND EDITION, REVISED AND ENLARGED.

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PREFACE.

THE increased demand for information on Gunnery and the success of his previous works have induced the Author to embody in one volume as full a description of firearms as is likely to interest the sportsman or inventor.

Much of the history of Ancient Arms has been gleaned from foreign writers, whose works have not appeared in English; and several of the illustrations are from original sketches of arms preserved in Continental museums and elsewhere.

The Author trusts that the notices of Hammerless Guns, Breech-actions, and the Extracts from the Gun Trials, together with the details of numerous experiments, will enable the sportsman to decide upon the weapons required for any particular shooting, and at the same time be of value to the inventor and gunmaker for reference.

The Shooting Notes have been compiled from information contributed by correspondents in all parts of the world, and the data now presented in a condensed form constitute a synopsis of the shooting-grounds of the globe.

The Author regrets that, although every endeavour has been made to render the book as readable as possible, a literary style has been found incompatible with the nature of the work.

W. W. GREENER.

BIRMINGHAM,
March 25th, 1881.

PREFACE TO SECOND EDITION.

CONTINUOUS improvements tending to the perfectment of arms, coupled with the exhaustion of the first edition, have necessitated the production of this revised issue of "THE GUN AND ITS DEVELOPMENT."

The Author has spared no effort to make the book complete as a cyclopædia of small arms; and wishful to report even the minutest point of progress, has noticed every invention pertaining to guns with—he trusts—perception, and appreciation of merit wherever existent. Such errors, whether of judgment or accident as were observable in the earlier edition, have been rectified, and the Author has endeavoured to treat of every subject fully and with fairness.

BIRMINGHAM,
January 1st, 1884.

CONTENTS.

THE GUN AND ITS DEVELOPMENT.

EARLY ARMS.

WHEN the aboriginal savage, loitering in forest glade or morass, found himself dependent on slaughter for food, he immediately felt the want of weapons to kill at a distance. The readiest, a flint, was doubtless the first used, and this, quickly followed by a predisposition for a certain flint, led to the securing of that flint by a thong to wrist or waist; thus could the chosen weapon be recovered, and quickly used time upon time till prey or savage were conquered. This weapon—the original of the sling-shot—still favoured by Caledonians, is in all probability the most ancient of weapons, and in a modified form is still made use of. From this ball of flint and thong attached thereto, it may be safely conjectured that the sling was developed. Possibly accident discovered the increased power of a sling-hurled projectile to that of the flint-ball hurled by unaided arm. Although at some past time in the world's history its use was almost universal, its invention is attributed by ancient writers either to the Phœnicians or the inhabitants of the Balearic Isles, who were extremely expert in its manipulation, and even at that early age made use of leaden projectiles, which it is said they could hurl over 600 yards. The sling was used for many centuries as a military weapon, and its last appearance was at the Huguenot War of 1572.

The bow was a separate invention of great antiquity, and for many centuries was considered the most effective offensive weapon in warfare. Great skill was attained by the ancients in its use, and many accounts are to be found in the writings of the ancient historians relative to the extraordinary force and precision with which an arrow might be projected. The long-bow has always been more essentially the universal weapon, the

cross-bow being a comparatively modern invention, and its use confined almost entirely to Europe. The bow was held in great estimation by the ancients, as is illustrated in a remarkable manner by the following passage from the "Iliad." It shows that the bow was sometimes employed to strike down a warrior too formidable to be attacked hand to hand, so that, whilst demonstrating its value, deprives it of any heroic character.

Æneas, observing the havoc that was made in the Trojan ranks by Diomedes, seeks for Pandarus, the skilled archer:—

> "Him, when Æneas saw amid the ranks
> Dealing destruction, through the fight and throng
> Of spears he plunged, if haply he might find
> The god-like Pandarus. Lycaon's son
> He found . . . . . .

and addressed him thus:—

> "'Where, Pandarus, are now thy wingèd shafts?
> Thy bow, and well-known skill, wherein with thee
> Can no man here contend? Nor Lycia boasts,
> Through all her wide-spread plains, a truer aim;
> Then raise to Jove thy hands, and with thy shaft
> Strike down this chief, whoe'er he be, that thus
> Is making fearful havoc in our host.'"—*Il.* v. 196.

On another occasion, before the effect of his arrow upon Menelaus is described, the poet tells us what the bow of Pandarus was like:—

> "Straight he uncased his polished bow, his spoil
> Won from a mountain ibex, which himself,
> In ambush lurking, through the breast had shot.
> True to his aim, as from behind a crag
> He came in sight, prone on the rock he fell;
> With horns of sixteen palms his head was crowned;
> These, deftly wrought, a skilful workman's hand
> Had polished smooth, and tipped the ends with gold.
> He bent, and resting on the ground his bow,
> Strung it anew. . . . .
> His quiver then withdrawing from its case,
> With care a shaft he chose ne'er shot before,
> Well-feathered messenger of pangs and death.
> The stinging arrow fitted to the string,
> At once the sinew and the notch he drew:
> The sinew to his breast, and to the bow
> The iron head: then, when the mighty bow

Was to a circle strained, sharp rang the horn
And loud the sinew twanged, as toward the crowd
With deadly speed the eager arrow sprang.
. . . . It struck
Just where the golden clasps the belt restrained,
And where the breastplate, doubled, checked its force.
On the close-fitting belt the arrow struck;
Right through the belt of curious workmanship
It drove, and through the breastplate richly wrought,
And through the coat of mail he wore beneath—
His inmost guard, and best defence to check
The hostile weapon's force: yet onward still
The arrow drove."—*Il.* iv. 119.

Fig. 1.—Saxon Bowmen.

The bow could not have been greatly improved till after the Norman Conquest, as we find that the Saxons, although they used the bow for sporting purposes, seldom if ever employed it in warfare.

In the adjoined illustration (Fig. 1) are shown two Saxon archers in search of game. One, accompanied by his dog, is in search of the wild deer; the other is depicted in the act of shooting at a bird, and, judging

from the adornment of his girdle, appears to have been a good marksman. In both cases it will be seen that the bows are mere toys, and possess one peculiarity—viz., the strings are not fastened to the extremities, but permitted to play at some distance from them. The original of the above engraving is to be found in an illustrated manuscript of the eighth century in the Cotton Library.

It is a disputed point whether the cross-bow or the long-bow was used by the Normans at the battle of Hastings. Most writers think the former, and it is generally believed that the cross-bow originated with the Normans or French.

Fig. 2.—English Long-bow man.

The long-bow, after the battle of Hastings, became more generally used in England, and was probably gradually developed from the short Saxon bow already mentioned. Shooting with the long-bow was for centuries the chief national pastime, and its practice was enforced by several Acts of Parliament. In the reign of Edward III. the use of the long-bow reached its zenith, and the battles of Creçy, Poictiers, Homeldon, Shrewsbury, and Agincourt were gained to the English through its instrumentality.

After these battles the prowess of the English archers or long-bow men was so feared upon the Continent as to give rise to several proverbs, some of which are said to be still current in France.

On the Continent the cross-bow, or arbalist, was almost entirely used, and no nation seems to have adopted even any modification of the English long-bow. Perhaps the cause of this was the great strength and continual practice required to make it successful as a military weapon. The English archer practised continually, and so arduous was the task that many Acts of Parliament were required to keep it in constant practice. As will be seen by the annexed engraving, Fig. 2, the

English archer drew the *bow-string* with his two or sometimes three fingers, to his right ear, thus obtaining a longer draw and more power than it was possible to obtain by holding the bow in the same manner as the ancient Greeks, who grasped the arrow with the thumb and finger, and pulled it towards the breast, and represented the fabled Amazons as doing the same (hence the tradition of their cutting off their right breasts would be applicable, as it would greatly facilitate the use of the bow). The Persians, however, drew the bow-string to the ear, and this method is the one still practised by the English. The archer also carried a mace, mallet, or cudgel, to despatch the wounded enemy, and mention is also made of a pile or pike of wood which was placed in the ground in a slanting direction, and intended to protect the archers from a charge of cavalry.

In the reign of Henry VIII. three several Acts were made for promoting the practice of shooting with the long-bow. One prohibited the use of the cross-bow and hand-guns: this was occasioned by a complaint from the Bowyers, the Fletchers or arrow-makers, the Stringers, and the arrow-head makers, stating that many unlawful games were practised in the open fields, to the detriment of public morals and the great decay of archery.

Those games were therefore strictly prohibited by Parliament; but the Act does not appear to have been strictly enforced, for it was repeated twenty years afterwards. A third Act followed, which obliged every man being a king's subject to exercise himself in shooting with the long-bow, to keep a bow with arrows continually in his house, whilst fathers and guardians were commanded to teach the male children the use of the *long-bow*, and to have at all times bows provided for them as soon as they arrived at the age of seven years; masters were ordered to find bows for their apprentices, and to compel them to learn to shoot with them upon holidays and at every other convenient time. By virtue of the same Act every man who kept a cross-bow in his house was liable to a penalty of ten pounds. It was also forbidden for any man over twenty-four years of age to shoot at a mark nearer than 220 yards with a flight-arrow, or 140 yards with a sheaf-arrow.

Henry VIII. was a great sportsman and patron of the chase; several matches of cross-bows versus long-bows were shot before him. He himself

was a great archer, and although generally using a long-bow (see Fig. 3), he frequently made use of the cross-bow when shooting for wagers. At the Field of the Cloth of Gold he shot against the French cross-bow men, and won their applause, putting his arrows successively in the centre at twelve-score yards, whilst they with their cross-bows were unable to hit the target. Great feats are mentioned by historians respecting the great force and precision of arrows shot by the English archers. The longest well-authenticated distance for shooting with flight-arrows is about 600 yards, and at 400 yards hazel-rods were frequently cleft by experts. Modern archers have in a few instances shot their arrows over 400 yards. The force with which the arrows were propelled seems incredible, for the old writer, Giraldus Cambrensis, states that some archers belonging to the Ventna, a warlike Welsh tribe, shot clean through an oak door, behind which some soldiers had concealed themselves, the door being no less than four fingers in thickness. A party of 100 archers shot before King Edward VI., at doubtless considerably over 220 yards (the minimum range), and pierced an oak plank one inch in thickness, several of the arrows passing right through the plank and sticking into the butts at the

Fig. 3.—Henry VIII., in Archer's Costume, shooting at the Field of the Cloth of Gold.

back. Neither was it uncommon for archers to pierce the armour of the knights with their heavy arrows; and even at this day the North American Indians will drive an arrow clean through a buffalo, though, of course, at close quarters.

In shooting with the long-bow two different kinds of arrows were used, one, the flight-arrow, was only used for long-distance shooting; it was a long light arrow with plain iron point. The other, called the sheaf-arrow, was shorter and heavier than the flight-arrow; it was tipped with a jagged barbed iron head, and, according to some writers, was two-pronged, like a fork. It made very dangerous and troublesome wounds, the barbed points, when once embedded in the flesh or bone, proved generally fatal, as the clumsy surgery of those days greatly increased the danger.

Several trials between the gun and the bow are on record, the results generally showing military advantages to the latter. A reliable match decided at Pacton Green, Cumberland, in August, 1792, resulted in a grand victory for the bow. The distance was 100 yards, the bow placing sixteen arrows out of twenty into the target, and the ordinary musket twelve balls only. A similar match took place the same year with very similar results.

Perceiving such results as these so late as the 18th century, it is not surprising that in its earlier days the gun proved an inferior weapon to the bow in the hands of a good archer.

There is no record of the muskets used at the trials above quoted, but in all probability the "Brown Bess" would be the one chosen, it being the standard military arm at that period.

THE ARBALIST OR CROSS-BOW.

The cross-bow appears to have been a modification of the Grecian catapulta shown in Fig. 4. The catapulta consisted of a powerful horn, wood, or steel bow, fastened transversely to a stand, and wound up by means of a windlass fixed upon another stand. Another weapon in use by the Greeks was the balista, which appears to have been a combination of the principles of the sling and of the cross-bow. Both were occasionally made of enormous size, and used in besieging towns. A common form of balista is shown in Fig. 4.

The invention of the cross-bow, as before stated, is attributed to

the Normans; no mention of it, however, can be found in any MS. of the period of the Norman invasion, neither does it figure in the Bayeux Tapestry. It was used in the First Crusade, and came into general use on the Continent soon afterwards. It remained in favour for many years, but disappeared from the French armies in the reign of Francis I. The cross-bow was looked upon as a most cruel and barbarous weapon, and Pope Innocent III. forbade its use between Christian nations, but sanctioned it in fighting against infidels. Richard I. introduced the cross-bow into the English army, against the wish of the Pope; and he

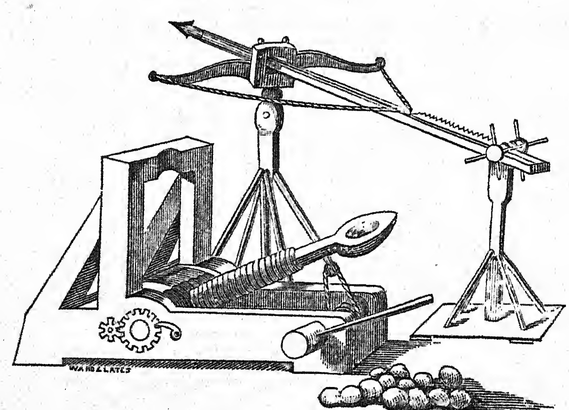


Fig. 4.—Balista and Catapulta of the Greeks.

being killed a few years later by a shot from one whilst besieging the castle of Chaluz, his death was considered as a judgment from heaven inflicted on him for his impious conduct.

The objection raised by the Pope against its use was the fearful wounds caused by the short heavy bolts, or quarrels, shot from the cross-bow. Several forms of these are shown in Fig. 5, but there were several other varieties in general use for game shooting, &c.

In the annexed engraving (Fig. 5) are given two representations of the cross-bow. One, the shorter, is upon the principle generally used for the military cross-bow. The bow is of steel, and the string is pulled by a hooked rod with a ratchet edge. The ratchet is wound up by means of the lever and cogs until the string is pulled over a movable nut or button

fixed to the stock. By depressing the lever underneath, the button is brought to the level of the stock; and the string slipping over it, the bow is released.

Many other systems have been employed to bend the cross-bow. In

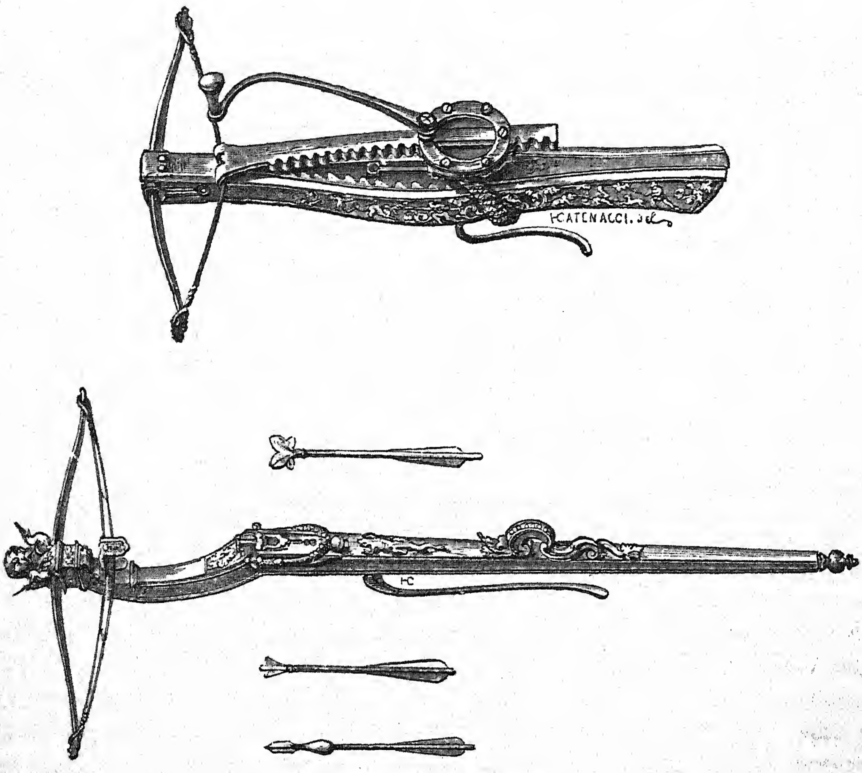


Fig. 5.—Cross-bows and Quarrels.

some cases a windlass with ropes and pulleys was used: it was fixed to the stock of the cross-bow after each discharge, but at the time of shooting or marching it was removed, and hung from the soldier's girdle. Others were cocked by means of a lever, and some had a pulley fastened in the stock, with a rope passing over it, to which a stirrup was attached. To

bend the bow, its head was rested on the ground, the foot inserted in the stirrup, and depressed. It may be easily conceived that these various appliances rendered the cross-bow a heavy and cumbrous weapon ; for the chase, however, a lighter weapon was used, which was strung by the hand. A highly ornamented cross-bow of this description is shown in Fig. 5, which represents the arbalist of Catherine de Medicis, preserved in the Musée des Invalides at Paris. The weapon is exceedingly light for a cross-bow, and is discharged by a trigger, working the nut. This principle of discharging cross-bows doubtless gave rise to the lock and trigger of the arquebus. The cross-bow had many disadvantages. It was clumsy, slow, and awkward to load, a long-bow man being able to discharge ten arrows while the cross-bow man was shooting three ; and the strings could not well be protected from rain. The range of the cross-bow was considerably less than that of the long-bow, 300 to 400 yards being the outside distance. It was, however, very accurate at short distances, and, on account of the heavy bolts it shot, was more effective in penetrating armour. About the middle of the fourteenth century an attempt was made to introduce the long-bow into France, to replace the cross-bow ; but the knights discountenanced the movement, as they foresaw that, if a good archer, a man of low position could accomplish greater feats than them-selves.

The cross-bow was greatly used for sporting as well as military purposes ; and it must have been a cross-bow that William Tell employed in his notable feat. The Genoese and Gascons were the most famous cross-bow men in the armies of Europe. It was doubtless from a cross-bow that William II. received his death. They were exceedingly dangerous weapons to handle, often going off unawares or by accident. In the old sporting works many accounts are to be found of sportsmen who have accidentally been killed by the cross-bow. The cross-bows of the four-teenth and fifteenth centuries were sometimes made with sights affixed to them. Some specimens possess a back sight having three or more peep-holes, one over the other, which are evidently intended as guides for elevation.

It will be seen from the foregoing remarks on long and cross-bows that the small firearms had most serious rivals to contend with ; and as the early arquebuses and culverines were exceedingly clumsy and cumbrous

weapons, it is not at all surprising to find that the gun was used side by side with the bow for several centuries. Such fine results had been obtained by the English long-bow men that, although in the time of Henry VIII. the arquebus had been brought to a far more perfect state than when first introduced, it was forbidden by Act of Parliament to be used, or even to be possessed, by any of the king's subjects. The bow, for several centuries after the invention of small firearms, was considered the most perfect weapon, and did not disappear from the English army until after the year 1627—a company of archers being present at the attack of the Ile de Ré in that year; and there is every reason to believe that a company of archers was raised to fight for King Charles I. in 1643.

Such were the offensive hand weapons against which the unperfected early firearms had to contend. The bow, the long-cherished weapon of the warrior, was only reluctantly laid aside for the cumbrous culverin or arquebus. Several trials between arquebuses and bows are upon record, some have already been cited, the guns were beaten, both for speed and accuracy. Sufficient information has been given respecting the bow to demonstrate that it was a formidable rival, and not the insignificant weapon it is generally considered. The use of the bow in England was continually being encouraged and enforced, as already mentioned, whilst portable firearms were altogether discountenanced. From this cause the search for early improvements in firearms, as well as for the invention of gunpowder, can only be successfully made by examination of foreign archives.

THE INVENTION OF GUNPOWDER.

The invention of gunpowder is observed in the mythical lore of ancient writers, but it is possible to trace it back many centuries prior to the Christian era. Most writers upon this subject seem agreed that it was known to the Chinese and Indians prior or contemporary with Moses, but the descriptions given are so vague that it is difficult to make the various accounts coincide. The earliest mention we have of gunpowder is in the Gentoo Laws, where it is mentioned as applied to firearms. This particular code is believed to have been coëval with the time of Moses. The notice is as follows:—

"The magistrate shall not make war with any deceitfull machine, or with poisoned weapons, or with cannons or guns, or any kind of fire-arms, nor shall he slay in war any person born an eunuch, nor any person who putting his arms together supplicates for quarter, nor any person who has no means of escape."

Gunpowder has been known in India and China far beyond all periods of investigation, and if this account be considered true it is very possible that Alexander the Great *did* absolutely meet with fire-weapons in India, which a passage in Quintus Curtius seems to indicate. There are many ancient Indian and Chinese words signifying weapons of fire, heaven's-thunder, devouring-fire, ball containing terrestrial fire, and such-like expressions.

Dutens in his work gives a most remarkable quotation from the Life of Apollonius Tyanaeus, written by Philostratus, which, if true, proves that Alexander's conquests in India were arrested by the use of gunpowder. This oft-cited paragraph is deserving of further repetition :—

"These truly wise men (the Oxydracæ) dwell between the rivers of Hyphasis and Ganges. Their country Alexander never entered, deterred not by fear of the inhabitants, but, as I suppose, by religious motives, for had he passed the Hyphasis he might doubtless have made himself master of all the country round them; but their cities he never could have taken, though he had led a thousand as brave as Achilles, or three thousand such as Ajax to the assault; for they come not out to the field to fight those who attack them, but these holy men, beloved of the gods, overthrew their enemies with tempests and thunderbolts shot from their walls. It is said that the Egyptian Hercules and Bacchus, when they invaded India, invaded this people also, and having prepared warlike engines, attempted to conquer them; they in the meantime made no show of resistance, appearing perfectly quiet and secure, but upon the enemy's near approach they were repulsed with storms of lightning and thunderbolts hurled upon them from above."

Although Philostratus is not considered the most veracious of ancient authors, other evidence corroborates the truth of this account, and it is now generally acknowledged that the ancient Hindoos possessed a knowledge of gunpowder-making. They made great use of explosives, including gunpowder, in pyrotechnical displays, and it is not improbable that they may have discovered (perhaps accidentally) the most recondite of its properties, that of projecting heavy bodies, and practically applied the discovery by inventing and using cannon. The most ingenious theory respecting the invention of gunpowder is that of the late Henry Wilkinson :—

"It has always appeared to me highly probable that the first discovery of gunpowder might originate from the primæval method of cooking food by means of wood fires, on a

soil strongly impregnated with nitre, as it is in many parts of India and China. It is certain that from the moment when the aborigines of these countries ceased to devour their food in a crude state, recourse must have been had to such means of preparing it; and when the fires became extinguished, some portions of the wood partially converted into charcoal would remain, thus accidentally bringing into contact two of the principal and most active ingredients of this composition under such circumstances as could hardly fail to produce some slight deflagration whenever fires were rekindled on the same spot. . . . . It is certain that such a combination of favourable circumstances might lead to the discovery, although the period of its application to any useful purpose may be very remote from that of its origin."

The introduction of powder into Europe took place early in the Christian era; some believe it was brought by the Moors into Spain, and others that it came through the Greeks at Constantinople. Both may be correct, but certain it is that it, or a substance closely akin to it, was used at the siege of Constantinople in A.D. 668. The Arabs, or Saracens, are said to have used it in A.D. 690 at the siege of Mecca; and some writers affirm that it was well known to Mahomet. In 846, Marcus Græcus, in his MS. entitled "Liber ignium," describes gunpowder as composed of six parts saltpetre and two parts each of charcoal and sulphur. This interesting MS. is still in the Royal Library at Paris, and the recipe given in it we may state is nearly akin to that formula now employed for mixing the ingredients of gunpowder.

There is a treatise in the Escurial collection of Spain upon gunpowder, written in 1249. It was probably from this work, or the writings of Marcus Græcus, that Roger Bacon derived his knowledge of gunpowder, although he describes it as in common use for pyrotechnical displays; he travelled in Spain, and it was probably immediately after his return that he wrote his work, dated 1267. Berthold Schwartz, a monk of Friburg, in Germany, studied the writings of Bacon regarding explosives, and manufactured gunpowder whilst experimenting. He has commonly been credited as the inventor, but at any rate the honour is due to him for making known the recondite properties of gunpowder, and its adoption in Central Europe quickly followed his announcement, which is supposed to have taken place about 1320. It is not improbable that gunpowder was well known in Spain and Greece many years prior to its being used in Central and Northern Europe.

CANNON.

As already mentioned, guns and cannon appear to have been well known to the ancients, but presuming that such accounts may be unreliable, it will be as well to treat only of cannon upon their introduction into Europe.

The first mention is that "Seville was defended in 1247 by cannon throwing stones"; Mibela in Spain was also defended by a machine resembling cannon, when besieged in 1259; in 1273 Abou Yousof made use of cannon throwing stone balls at the siege of Sidgilmessa; and in 1308 Ferdinand IV. of Castile, at the siege of Gibraltar, employed guns (or Marquinas de Trueñas); and in 1311 Ismail attacked Bazas, a town of Granada, with machines "throwing balls of fire with a noise resembling thunder." These notices seem to confirm the opinion that the use of cannon and powder was known to the Arabs or Moors, and introduced by them into Spain, from whence it spread over Europe. In the chronicle of the town of Ghent for 1313 it is stated that the town was possessed of a small cannon; and in the records of the Florentine Republic mention is made in the year 1325 of two officers being ordered to manufacture cannon and iron bullets, for the defence of the castles and villages belonging to the Republic. This MS. is still in existence, and fully proves that cannon were known in Italy prior to 1325. The first German cannon belonged to the town of Amberg, and bears the date of 1301. The English appear to have imported them from Flanders, for King Edward III. in 1327 employed some Hainaulters who used them in his war with the Scotch. In 1331 cannon were used by the King of Granada against Alicante, in 1339 at the siege of Puy-Guillem, and in the same year at the siege of Cambray by Edward III., in 1340 by Lequesnoy before Mirepoix, in 1345 before Monsegur, and in 1346 at Creçy. There are many instances of cannon being used in the second half of the 14th century. To cite a few only. About 1350 the North German knights had iron guns, and a little later the Free Hanse Towns armed themselves in the same way. In the year 1356 appear large amounts in the accounts

of the town of Nuremberg as having been spent in purchasing cannon and guns; and in 1365 Duke Albert of Brandenberg defended Einbeck *very effectually* "with fire boxes."

The early cannon of Europe were known by various names in the different countries. In Italy they were known as bombardes—probably derived from "a bombo et ardore" on account of the great noise which the firing of them occasioned. The French called them "quenon" or "canon"; the Germans "buchsen" or "boxes"; and the Netherlanders "vogheleer" or "veugliares"; besides these terms there were many others applied to the various models, but it was not until the commencement of the fifteenth century that cannon were classified and named according to their size. Cannon

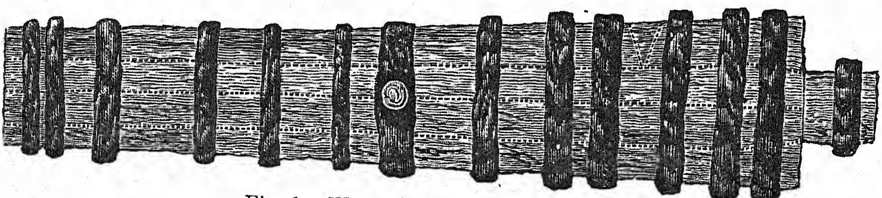


Fig. 6.—Wooden Cannon of Cochin China.

were not adopted or manufactured in France until 1338, and even for many years afterwards the French looked upon those nations who used them as "barbarians." The early cannon were made of wrought not cast metal, the first account of cast cannon being in 1378, when a founder named Aran, at Augsberg in Germany, cast thirty of a metal composed of copper and tin. In 1413 Mahomed II., at the siege of Constantinople, had an enormous cast cannon. The bore is said to have been forty-eight inches in diameter, and the stone bullet to have weighed 600 lbs. There is in the Musée des Invalides at Paris, a wooden cannon from Cochin China. This curiosity is shown in Fig. 6; and, considering that the Chinese and other Eastern nations have not made any advance in civilisation for many centuries, it is just probable that this cannon is similar to those used in the most ancient times by these people.

It will be seen from the engraving that the cannon is composed of three pieces of wood and 14 iron rings. The body of the cannon is in two pieces, each having a groove in its centre, the two pieces are laid

together with the grooves coinciding with each other, and hooped together. The breech consists of a wooden plug, dovetailed into the two pieces forming the cannon, and is bound with one iron ring. The joint of the two pieces is shown in the engraving, and the relative size and shape of the interior of the cannon, the dovetail of the breech-block, and the position and shape of the touch-hole, are shown by the dotted

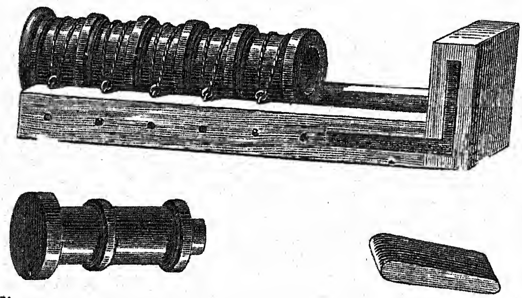


Fig. 7.—Breech-loading Cannon of the Fourteenth Century.

lines. This cannon is about 8 feet long, the bore is about 6 inches in diameter, and it has trunnions of iron. The cannon is of hard light-coloured wood, and does not appear to have been very much used. Besides wood, leather and rope have been used in the construction of firearms. In the arsenal of Venice there is a large mortar composed of several thicknesses of coiled hempen rope, covered with a thick casing of leather. This weapon was captured from the Turks, and fired a shell about 18 inches in diameter. Mortars composed of paper with an outside covering of leather are preserved in the arsenal at Malta, and are considered great curiosities; they were probably of Eastern manufacture, and used during the Crusades, or perhaps even earlier.

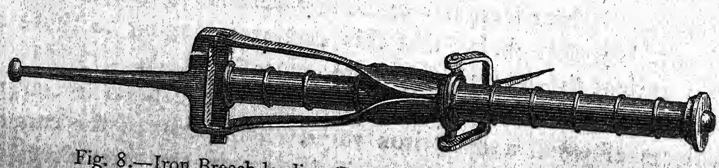


Fig. 8.—Iron Breech-loading Cannon of the Fourteenth Century.

The early European cannon were, however, made of wrought-iron, and loaded at the breech. In Fig. 7 is shown one of these old cannon.

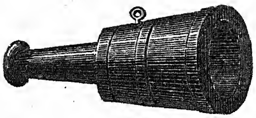


Fig. 9.—Italian Bombarde, after Marianus Jacobus.

It will be seen that it consisted of a wrought-iron barrel and a movable breech-block and wedge shown detached. The cannon was fastened to

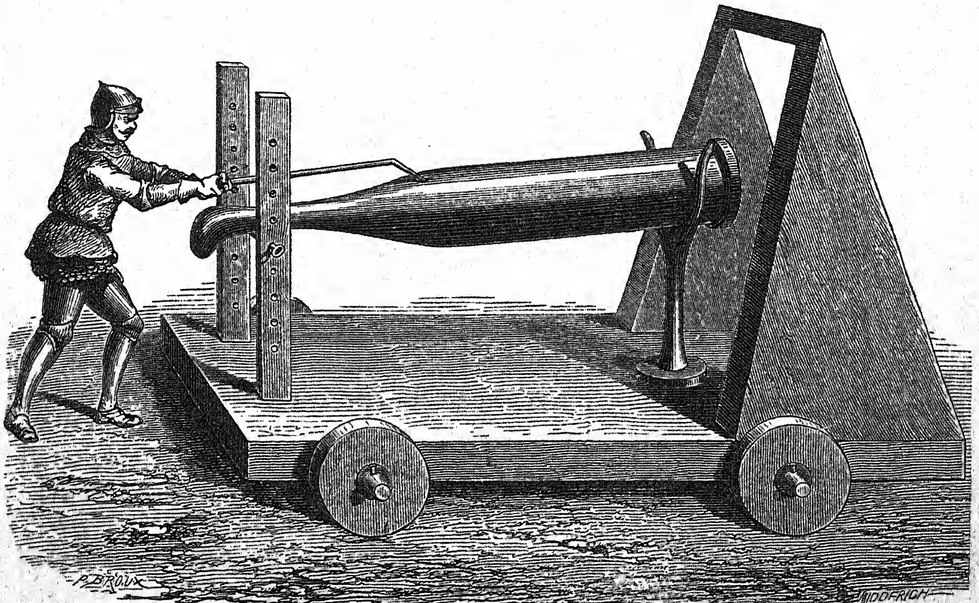


Fig. 10.—Italian Cerbotain of the Fourteenth Century Mounted upon a Semi-portable Carriage.

a wooden frame, as shown in the engraving; after the gun was loaded the breech-plug was placed in a groove in the wooden frame, and driven forward by means of a wedge until its chamfered end was driven tightly into the chamber of the barrel, the whole strain of the explosion was

borne by the upright portion of the wooden frame; had the powder been strong or large charges used, it is certain it could not have remained intact for any length of time.

Another cannon of a similar principle, but constructed wholly of iron, is shown in Fig. 8.

These cannon had trunnions, and were frequently mounted upon swivels, and used as wall pieces. They were more serviceable than the cannon already described, but owing to the imperfect manner of connecting the breech-block frame with the cannon, they could not withstand the repeated

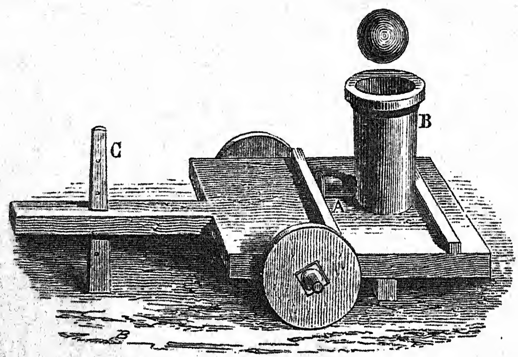


Fig. 11.—The Elbow-joint Bombarde.

strain. They were mostly constructed with the metal at the muzzle much thicker than at the breech; this probably arose from the want of mechanical knowledge, and with the idea of preventing the muzzle from jumping up at the moment of discharge. Several of these ancient arms are to be seen in the Musée des Invalides at Paris.

Mortars or bombardes were amongst the first varieties of firearms used in Europe. An early Italian bombarde is represented in Fig. 9; it is extracted from a manuscript by Marianus Jacobus of Venice, written in 1449. The powder-chamber or arm of the bombard is of a much smaller diameter than the forepart of the weapon; both of the chambers were of a conical shape in order that various-sized missiles might be thrown.

The bombards, and indeed all the early cannon, were short, the barrel in most instances being only just long enough to hold the charge of powder and

the missile. In some cases they were made of solid stone, being hollowed out until of a sufficient depth to hold the charge, and it is probably from this description of arm that the word "mortar," as applied to fire-arms, originated. Gradually the chambers of the cannons were lengthened, and the weapons mounted upon portable carriages. Shown in Fig. 10 is an Italian Cerbotain, or "Blow Tube," of the later half of the fourteenth century.

This bombard has also the diminished powder-chamber, but the metal is nearly the same thickness the whole length of the tube. The

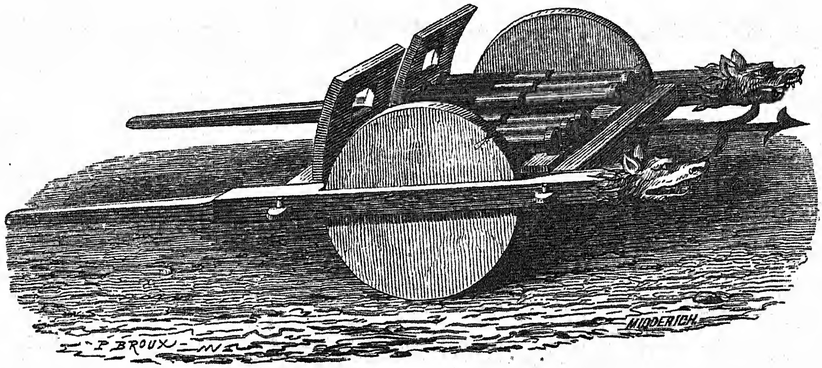


Fig. 12.—French "Orgue des Bombardes."

stand consists of a forked rest, which supports the muzzle of the weapon, and an adjustable vertical support for an elongated arm projecting from the breech of the cannon. The construction of the carriage will be better understood upon reference to the engraving. The early cannon were not supplied with any contrivances for sustaining the recoil, the cannon being allowed to move back upon the discharge. In this cerbotain the amount of travel was limited by the collar placed upon the mouth of the weapon. The soldier is shown applying fire to the charge by means of a heated iron rod, the inference is that the weapon could only have been intended for defending towns or castles, and not for besieging. Another Italian bombard is shown in Fig. 11. In this bombard the powder was put in from the breech, and the missile from the muzzle. It was called the

elbow bombard (bombardo cubito). As will be seen from the engraving, the tube of the cannon, B, was fixed at right angles with its carriage or stand A; an aperture in the side of the tube allowed an iron breech, A, containing the powder, to be inserted horizontally, the plug being kept firm in the tube by means of a wedge bearing against it, and a transverse piece of wood affixed to the frame. In firing, the angle was somewhat modified by means of the prop, C. This species of bombard was used by the Italians chiefly about the latter half of the fourteenth century. About this time also weapons known as "Ribeaudequins" were used. This species of artillery was of Italian origin, and consisted of a number of short cannon and pikes, arranged and fixed upon a portable carriage.

Shown in Fig. 12 is an "orgue des bombardes," which differed only from the ribeaudequin in having more cannon and less pikes and spears. These weapons were only fired once during a battle—at the commencement. They were defensive weapons, the intention being to enclose a space with several of them, behind which the troops might shelter if charged by cavalry. The spikes in front prevented any sudden onslaught.

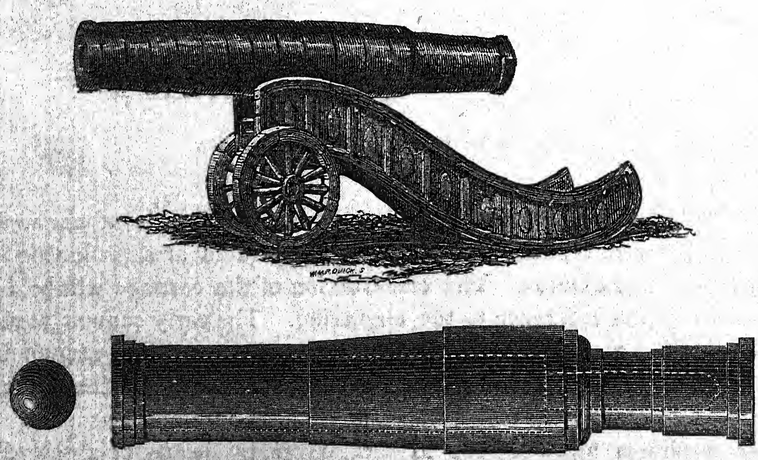


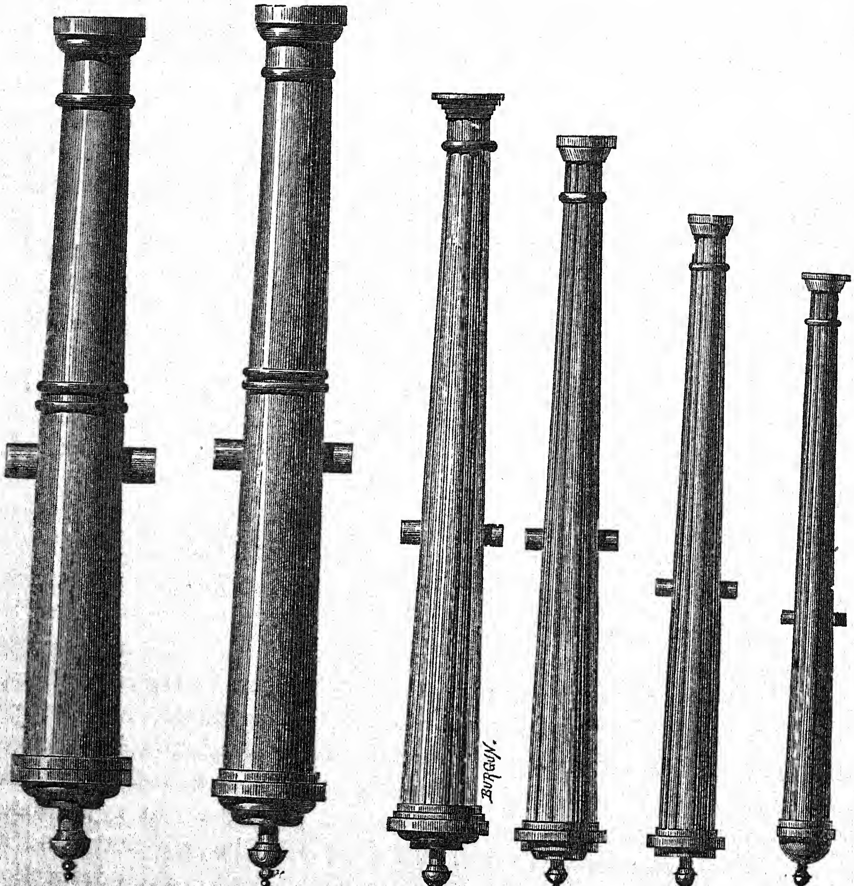
Fig. 13.—The "Mons Meg" of Edinburgh Castle, as it is, and as restored by M. Louis Figuier.

A cannon typical of the fifteenth century is the renowned "Mons Meg" of Scotch history and Flemish manufacture.

In this description of cannon the powder-chamber was less in diameter than the barrel of the cannon, as shown in the dotted lines, Fig. 13. They were frequently made of a large size, the "Mons Meg" weighing nearly four tons, and shooting a stone bullet weighing over 350 lbs. The touch-hole was placed a little in front of the powder chamber, in an oblique direction. These cannon being constructed smaller at the breech-end, and the metal there being not thicker than at any other part, they were unable to withstand the great strain, and frequently gave way just at the juncture of the powder-chamber and the barrel. The early cannon were generally made from iron bars, which were laid side by side longitudinally, and kept together by iron rings forced over them whilst red-hot. In the earliest cannon the rods were not even welded to each other, and in those of later date, although the rods were welded together, forming an internal tube, the tube itself was not welded to the metal rings forming the cannon, but was secured at the breach-end only, by the rings being welded over projecting shoulders upon the rods. Cannon of the same description as the "Mons Meg" were manufactured in considerable numbers at Ghent during the fourteenth and fifteenth centuries. Several were imported into Scotland; and history states that it was by the bursting of one of these cannon that King James I. of Scotland met his death. Towards the latter half of the fourteenth century, cast cannon were made in Italy and France, and were ornamented with different devices. In the reign of Charles V. the French cannon were classified according to their size and length. The cannon were mounted during his reign upon carriages, and had trunnions and handles, and the touch-holes were covered with hinged flaps. The cannon of the French army then consisted of mortars, four sizes of cannon throwing bullets weighing from 6 to 40lbs. each, and were called respectively, cannons, culverins, sackers and falconets. In 1551, under Francis I., the artillery of the French army consisted of six pieces, and as they included the leading styles of cannon of this period, a full description will not be out of place.

The "cannon" was nearly 9 feet 10 inches long, weighed 5,300 lbs., carried a bullet $33\frac{1}{4}$ lbs., and was drawn upon a carriage by twenty-one horses.

The "great culverin" was nearly 10 feet long, weighed 4,000 lbs., carried a bullet 15 lbs. 2 ozs., and was drawn by seventeen horses.



Cannon. Great Culverin. Bastard Culverin. Culverin. Falcon. Falconet.

Fig. 14.—The Cannon of France under Francis I., 1515—1547.

The " bastard culverin " was 9 feet long, weighed 2,500 lbs., and carried a bullet weighing 7 lbs. 2 ozs. ; it was drawn by eleven horses.

The " small culverin " weighed 1,200 lbs., and carried a bullet weighing 2 lbs. The "falcon" weighed 700 lbs., and carried a bullet of 1 lb. 10 ozs. ; and the " falconet," which was 6 feet 4 inches long, weighed 410 lbs., and carried a 14 oz. bullet.

These cannon were of a bronze alloy, formed by mixing nine parts of copper to nine parts of tin.

The German cannon of the middle of the sixteenth century are

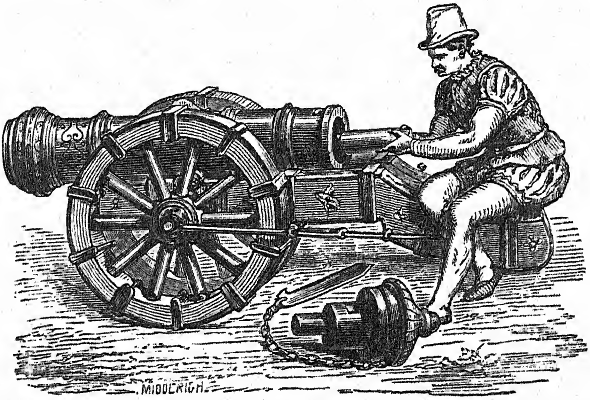


Fig. 15.—German Breech-loading Cannon of the Sixteenth Century.

described by Senfftenberg, an officer of artillery at Dantzic, in his book written in 1580. From his description it appears that the German cannon or field-pieces of that time were breech-loaders, and had enormous rings of metal round the muzzle.

Fig. 15 is a representation of one of these German cannon, showing the breech-block detached, and the mode of loading.

After the charge had been placed in the cannon, the breech-block, or plug, was inserted, and kept in position during the discharge by the wedge, passing vertically through a slot in the cannon and breech-plug. This cannon, as will be seen by the engraving, was mounted upon a two-wheeled carriage; it, however, had no trunnions. The immense rings at

the breech and muzzle were intended to shield the gunner whilst aiming. Breech and muzzle-sights were also affixed to these cannon.

A cannon somewhat similar in construction was used in the English army during the earlier part of the sixteenth century. A specimen of this description of cannon is still preserved in the Tower of London, and is represented in Fig. 16.

It will be seen that the charge is inserted in the breech, and the aperture filled by the breech-plug, which was lifted into position by the handles, conveniently placed on the top, and retained in its place during

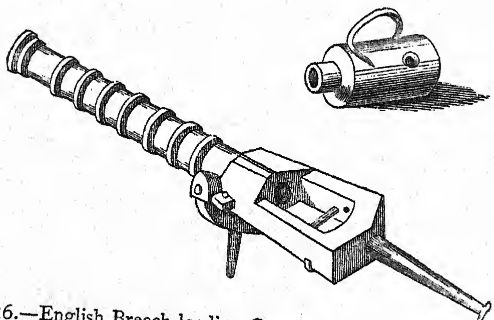


Fig. 16.—English Breech-loading Cannon of the Sixteenth Century.

the discharge by means of the round bolt passing horizontally through the sides of the cannon and the breech-plug.

We must now proceed to notice early English firearms. Although used by Edward III., they do not appear to have been well received in England; and no improvements are to be found in them until the reign of Henry VIII.; neither have we been able to find any account of the number or size of the cannon employed in the English army before his reign. It is due to Mr. Dean's praiseworthy exertions that several brass and iron guns belonging to the *Mary Rose* have been recovered, and which throw some light upon the English artillery of this period. The *Mary Rose*, an English vessel, was wrecked in the reign of Henry VIII., about 1545, while standing along the coast. During a distant firing from the French fleet, under Admiral Annebout, she was overpowered by the weight of her ordnance, and sunk, together with her commander and 600 men.

One of the iron guns is in a good state of preservation, and the accompanying engraving will convey a faint idea of its construction.

The gun is composed of a tube of iron, its joint overlapping and running the entire length of the barrel. Upon this tube is a succession of hoops composed of iron three inches square, being in fact immense rings. These were driven on whilst red-hot, and by their contraction formed a much stronger gun than would at first sight appear probable. It was affixed to a large beam of timber by means of iron bolts, similar to the

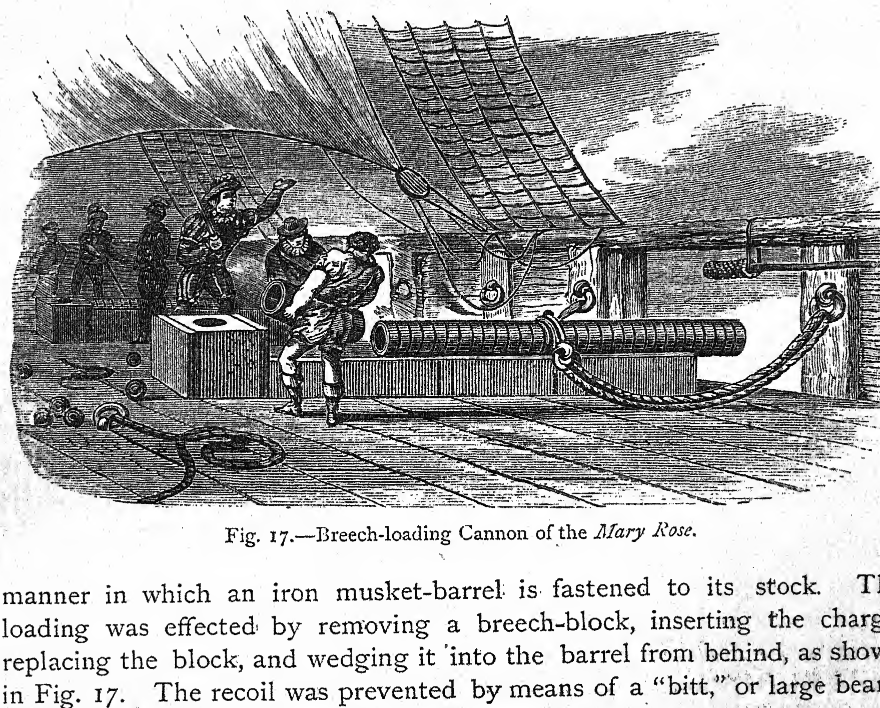


Fig. 17.—Breech-loading Cannon of the *Mary Rose.*

manner in which an iron musket-barrel is fastened to its stock. The loading was effected by removing a breech-block, inserting the charge, replacing the block, and wedging it into the barrel from behind, as shown in Fig. 17. The recoil was prevented by means of a "bitt," or large beam, fixed perpendicularly in the deck. There appears to have been no means available for raising or depressing the muzzle.

Henry VIII. also applied cannon for the defence of his baggage-wagons. Cannon were at first fired from stands or fortifications, and afterwards from semi-portable frames or carriages, as shown in Figs. 10, 12. Henry VIII. and Francis I., however, mounted their cannon upon travel-

ling carriages, and it was considered a great achievement for them to be drawn by horses, and accompanying the army, instead of, as previously, having to be brought with the baggage-wagons by oxen.

Fig. 18.—Gun-carriage and Team of Horses, Sixteenth Century.

We show in the accompanying engraving, Fig 18, a carriage and team for a seven-pounder of the reign of Louis XIII.

The carriage of the cannon represented in Fig. 15 is a fair type of the German carriages of the sixteenth century, and we have already stated that six pieces of field artillery used in the French army during the reign of Francis I. were mounted. A large number of early cannon were made without trunnions, being fixed to frames and elevated by a block at the breech-end. Other early guns that were mounted were made with a loop underneath the barrel before the reinforce, and pivoted upon a transverse pin. We show in Fig. 19 a gun so mounted, which shows also the tools required for charging the gun. The powder-bag, bullets, wadding and carriage, are also depicted. The representation is from a bas-relief upon the church of Genouillac, sculptured probably at the commencement of the sixteenth century. About the middle of the sixteenth century several peculiar varieties of cannon were constructed. They were in some instances made with the bore resembling in shape an elongated oval, in others the bore is oblong. The use made of these weapons appears to be the firing of chains, bars, and chained and barred shot. Three cannon were sometimes welded together side by side, and used for the same purpose. Several of such weapons are to be seen in the Tower of London, and also specimens of the shots and bars fired by them. We have already described

several of the early mortars, and indeed all the early short cannon appears to have been identical with the mortars, for they were charged to the muzzle, and in most cases shot at an extreme angle. In the early cannon no attempt appears to have been made at boring the tube. In many cases the powder-chamber was of a less diameter than the bullet, and the touch-hole placed just in front of the powder-chamber. Mortars were classed separately from the cannon by Charles V.; but they appear to have thrown stone or solid metal bullets, not shells.

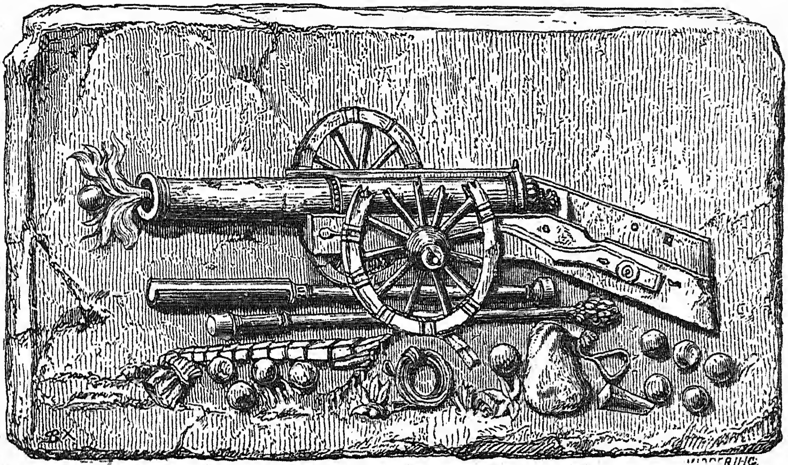


Fig. 19.—Bas-relief from the Church of Genouillac, Sixteenth Century.

Paul Jove, a historian contemporary with Charles VIII., and who chronicles the campaign of that monarch in Italy, says that the falcons and cannon of smaller calibre fired leaden bullets containing "bloqueraulx," or thimbles of iron. Explosive bombs, or "grenades," appear to have been first used by the Germans. They consisted of hollow metal balls filled with fine gunpowder; the ball was surrounded by a slow-burning coat, and the whole contained in a case, the inflammable coat being ignited immediately before throwing the bomb. To the Netherlanders, however, is due the honour of successfully applying the explosive shell to firearms. This nation appears to have greatly improved the cannon and mortars and other firearms during the fifteenth, sixteenth, and seventeenth cen-

turies. In the sixteenth century they successfully employed the explosive shell in conjunction with other missiles fired from their mortars. The accompanying illustration represents the mode of firing a mortar and bomb-shell, or, as they were then called, explosive bullets, or grenades.

The bomb, after being filled and a slow match placed in the aperture, was put into the mortar with the match projecting from the mouth of the mortar. This was first lit and afterwards the charge ignited. The system was found to be dangerous to the users, as in

Fig. 20.—Soldier Firing a Mortar and Bomb-shell requiring Double Ignition.

case of a misfire of the charge in the mortar, there was every probability of the shell bursting before the priming could be replaced or the shell extracted. The Germans improved upon this plan by the bomb with a single ignition. Senfftenberg of Dantzic, in his book already mentioned, describes the new invention as consisting of a slow match composed of two different materials. The match consisted of a metal tube, fixed in the "shell," containing a slow-burning mixture in order to ensure the shell reaching its destination before bursting. The tube was capped on the outside of the shell by a coil of highly-inflammable vegetable composition. The bomb was placed in the mortar, as shown in Fig. 21, with the coiled cap of the shell pro-

jecting into the powder-chamber. Upon the discharge of the mortar the powder ignited the cap which fired the slow-match in the tube leading to the interior of the shell. Senfftenberg stated that there was one drawback to this shell, viz., in making night attacks the burning tow on the shell lit up the surrounding country and showed to the enemy the position of the besiegers. Shortly afterwards oval bombs were successfully used, and shells made in two or more pieces and bolted together. Mortars were affixed to stands capable of firing a bullet at any elevation between 40 degrees and the perpendicular.

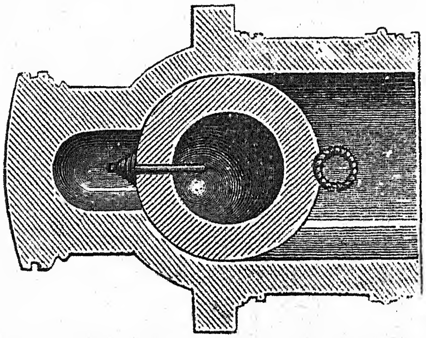


Fig. 21.—Mortar and Shell requiring Single Ignition only.

Cannon and mortars until the middle of the sixteenth century were chiefly used for besieging castles and towns, as they were too heavy to follow the movements of a body of troops on the battle-field.

Field-artillery were used by Charles V., Francis I., and Henry VIII., the lighter cannon being mounted upon carriages to facilitate their transport, and enable them to be quickly removed from one position to the other.

Besides the arms here shown, and those already described, various other ancient weapons, under different appellations, were in use. The "Minyon" was a long cannon of about 3-inch bore, coming between the culverin proper and the bastard culverin. So other weapons were known by different names, according to their length and bore. The

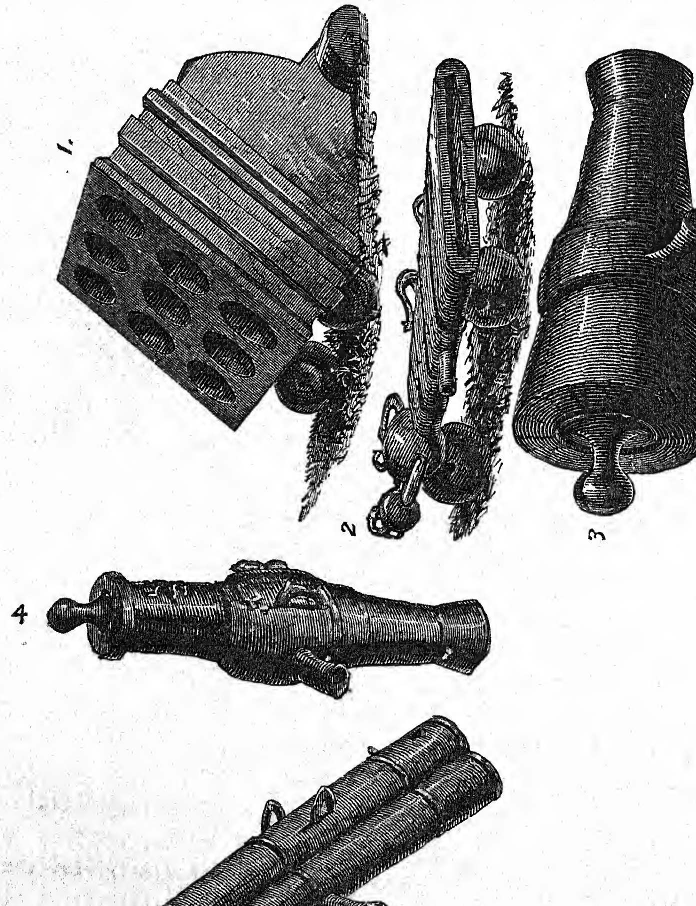


Fig. 22.—Curious Cannon.

"Sacker," or "Sacar," was a short cannon, about three inches bore, and the "Serpentin" a long, light cannon of small bore, and semi-portable, with the mouth formed to resemble the head of a serpent, griffin, or some fabulous monster.

The petard was a peculiar arm used for affixing to doors or walls in order to effect a breach. It consisted of a short gun, or rather cannon loaded to the muzzle, and fixed in a peculiar manner against the surface to be blown apart, so that when fired the door or wall should receive the shock, and not the petard.* Their use has long been discontinued, bags of gunpowder hung against barricades answering the purpose just as well.

Instead of the petard, a peculiarly-shaped mortar was sometimes used to make breeches in barricades at close quarters. The illustration No. 2, in Fig. 22, will give an idea of the shape of this weapon. It was charged to the muzzle, and bars of iron fired from it.

Mortars to fire three or more projectiles at the same time were also in use during the sixteenth century. They were fired simultaneously by means of common touch-holes communicating with each chamber. One to fire nine projectiles is preserved in the Tower Yard, and is illustrated in No. 1, Fig. 22.

Cannon were also similarly constructed as illustrated in No. 5, which consists of three round cannon welded together. The same system is employed in No. 6, but the barrels are made from one solid piece like the mortar, No. 1, and strengthened by iron bands driven over the piece. This latter is a breechloader; three movable breech-blocks being required, which are wedged up from behind.

In cast cannon the shapes greatly varied. One cast during the reign of Charles II. is shown in No. 3; it has a very plain exterior, but is more scientifically formed than No. 4, which represents a cast Russian cannon made at a St. Petersburg foundry in 1783, a date at which English and French cannon were well formed and capable of attaining long and uniform ranges. All the cannon hitherto mentioned were incapable of projecting missiles over any extensive range. The windage in all was very great, and the elevation required considerable.

These remarks upon early cannon may be aptly concluded by an illustration from a painting of the early part of the sixteenth century, showing the manner of besieging at that period.

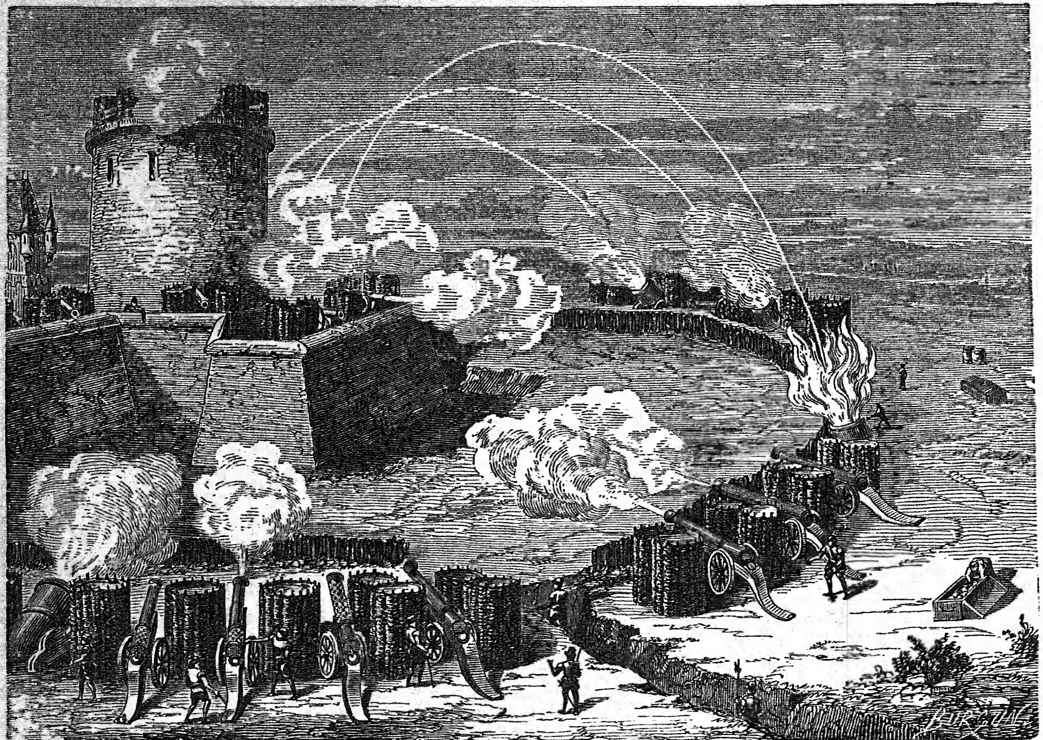


Fig. 23.—Besieging a Fortified Castle, Sixteenth Century.

EARLY HAND-FIRE-ARMS.

PORTABLE FIRE-ARMS.

IN the chapter on ancient artillery it was shown that the earliest cannon appear to have been made in various sizes, some of them being sufficiently portable to be carried and used by three or four men. During the fourteenth century cannon of a semi-portable nature were extensively used; adjoined is an illustration of one of these cannon.

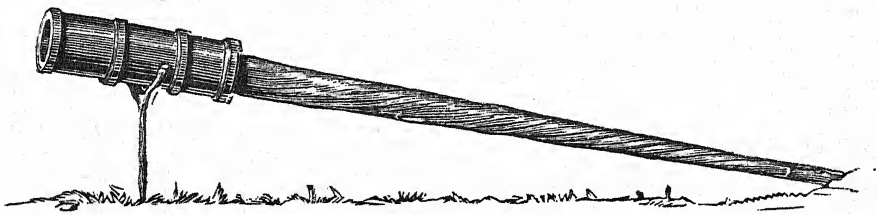


Fig. 24.—Semi-Portable Cannon on Forked Rest.

Upon reference to Fig. 24 it will be observed that the weapon consists of a small cannon fixed upon an elongated stock. The gun is fired by a touch-hole on the top; the cannon rests upon a forked support, with the extremity of the stock upon the ground, and generally abutting against a knob to prevent recoil. Such weapons were used in Europe at the commencement of the fourteenth century. Although not strictly speaking hand-fire-arms, they were carried by the soldiers and placed upon the ground for firing. It is stated by some writers that hand-guns were used at Creçy, but they were probably small cannon similar to the one shown in Fig. 24 and fired from the ground.

Amongst the Eastern nations, a pyrotechnical piece was developed into a species of hand-gun and used for military purposes, and especially adapted for causing a disturbance among troops, frightening horses, and stampeding cattle. This weapon is illustrated in the "Dictionnaire

Mobilier Français," and, according to that work, was also used by incendiaries, pillagers and outlaws. Fig. 25 illustrates the minutiæ of this peculiar weapon.

B shows the extreme aspect of the gun. A is an end elevation, and C a sectional view showing the construction. The gun consisted of an iron tube about six feet long, covered with two hollowed pieces of wood, and bound round with hair, hemp, hide, or other suitable substance. The charge is composed of, first, a bed of fine gunpowder, four fingers in thickness, then a bullet made of hempen stuff mixed with powder, wax, &c., then a layer of coarse powder, composed of powdered glass, grecian wax, steel filings and saltpetre, then two fingers of fine powder, a bullet, and then the coarse powder and fine powder and bullet alternately, unti

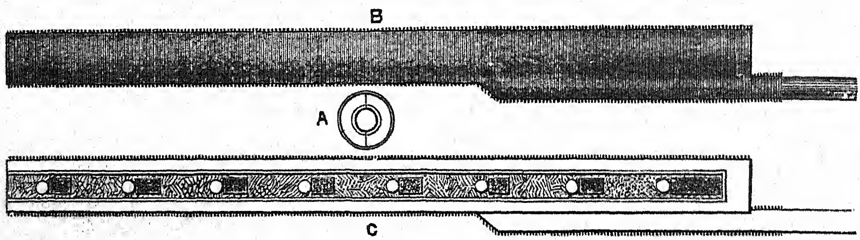


Fig. 25.—Pyrotechnical Hand-weapon.

loaded to the muzzle; it will thus be seen that the weapon greatly resembled a *Roman candle* or *pump*, throwing successively burning wax and inflammable balls. The weapon was, of course, fired from the muzzle, and the whole tube bound upon a stick, to handle it during the discharge. It is said that such weapons were in use amongst the Arabs until the fifteenth century.

The Italians and Netherlanders, about the year 1364, manufactured "crash guns" or small cannon, expressly used for making a report; indeed, this appears to have been the most valuable and satisfactory performance of the early guns, for Montaigne wrote in 1585, when of course numerous improvements had taken place, that the effect of firearms, apart from the shock caused by the report, to which one does not easily get accustomed, was so insignificant that he hoped they would be discarded.

In 1397, mention is made in the Chronicles of Boulogne of "hand-cannon," or, as they are designated, "sclopos," which afterwards became "sclopeto," and hence "escopette," "escopeta," &c. The "hand-cannon," as first used by the French, Italians and Netherlanders, consisted of a small bombarde (*bombardello*) affixed to a straight piece of wood, and fired from the shoulder by means of a match, as shown in the accompanying illustration (Fig. 26). A slight modification of this weapon rendered it applicable for use upon horseback. Instead of being fastened to a stock, the bombarde was welded on to an iron rod about 30 inches long; the

Fig. 26.—Foot Soldier Firing Hand-cannon, Fourteenth Century.

extremity of the rod was pierced and a cord passed through, and thus suspended from the neck of the soldier.

The bombarde was supported by a forked rest projecting from the saddle-bow, and pointed by the left hand, the right serving to apply the fire to the touch-hole. The adjoined illustration (Fig. 27) represents a cavalier firing a bombarde. It is from the MS. of Marianus Jacobus, written in 1449, and already referred to.

The German "Ritters" were the first to employ hand-bombardes, or "petronels," from horseback, and greatly astonished the French foot-soldiers by their use. These arms were called by the French Poitrinals,

from their being fired from the breast, afterwards corrupted into pétrinals; other writers, however, say the word is derived from the Spanish "pedernal;" the Germans called them Knallbuchsen (pop-guns). The first account we

Fig. 27.—Cavalier Firing Petronel (after Marianus Jacobus).

have of hand-cannon being used in Germany was in 1381, when the town of Ausburg supplied thirty men armed with them to the contingent of the Suabian towns in their war against the South German nobles.

We now arrive at the invention of the Hand-culverin (Coulverine à la

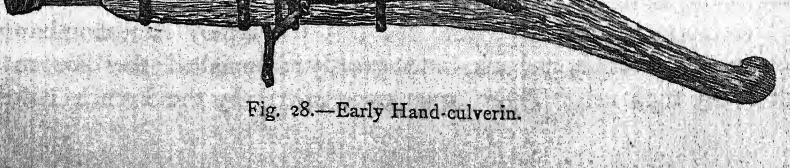


Fig. 28.—Early Hand-culverin.

main). This consisted of a small cannon affixed to a stock by iron bands. Fig. 28 represents one of these hand-culverins. The barrel is of forged iron, the stock of rough wood nearly straight, the barrel being fastened to it by the five iron bands, and the two side bridles fastening the trunnion or swivel band to the butt. These culverins were of small bore (about $\frac{1}{2}$ or $\frac{3}{4}$ inch), and were extensively used towards the close of the fifteenth century; for at the battle of Morat, in 1476, the Swiss army counted not less than 6,000 culverins. The Hand-culverin required two men to manipulate it. It was fired from a rest, sometimes forked (fourquine), and sharpened at its lower extremity to obtain a firm hold in the soil; the rest also served for a ramrod. One man (the culveriner) levelled and held the weapon during discharge, whilst his companion (the gougat) applied the priming

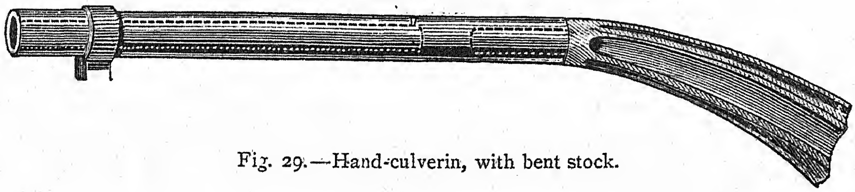


Fig. 29.—Hand-culverin, with bent stock.

and the match, and assisted in loading and carrying the weapon. The culverin was improved at a later date by having the bore enlarged, the stock more bent, and affixed to the barrel by entering into a recess in its breech-end, as shown in the accompanying illustration (Fig. 29) by the dotted lines. The internal bore of the barrel and the position of the touch-hole are also shown by the dotted lines. A forked rest was used with this culverin, and in some instances the stock was ornamented with grooves of various sizes. The culverin was afterwards improved by placing the touch-hole upon the side, with a flash-pan for the powder, as shown in Fig. 30. The barrels were also made of bronze, and cast in octagonal or sexagonal form; the stock, too, was lengthened, fitting under the arm, and shaped like the butts of modern punt-guns. Several good specimens of these early culverins are to be seen in the Musée des Invalides, at Paris. The culverins varied greatly in their dimensions and weight; the smallest, for horseback use, and similar to, or identical with, the pétrinal, were about 4 feet long, and

weighed from 10 to 15 lbs; the larger culverins were from 4 to 8 feet long, and weighed from 12 to 60 lbs. By the end of the fifteenth century hand-cannon were in use throughout Europe as military weapons. Charles VII. had a corps of horse-culveriners, and the hand-culveriners of Charles VIII. played an important part in Italy during his campaign in 1494. Hand-cannon were also used by the Emperor Sizgimund, who led 500 men armed with "rest-guns" in his Roman campaign in 1430, where they created a great sensation, although similar guns had been made at Padua as early as 1386. Hand-guns figured conspicuously in the Hussite wars, and at the siege of Lucca by the Florentines in 1431. All these early hand-guns were

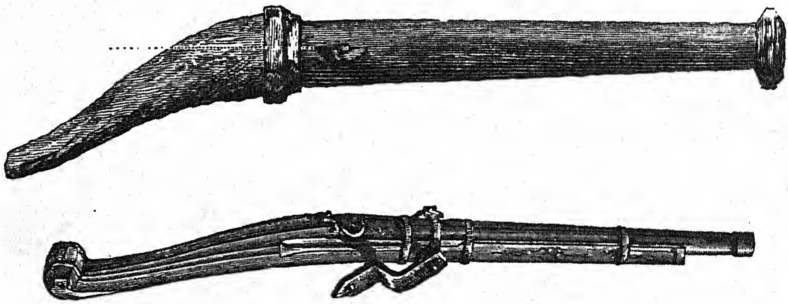


Fig. 30.—Culverins with side Flash-pans.

however, roughly constructed, for their accuracy in hitting was as small as the trouble of loading was great, and their imperfections as numerous as those of the gunpowder with which they were fired, which was veritably powder, resembling dust—powder not being granulated till about 1450.

Small firearms were introduced into England by Edward IV. in 1471, when he landed at Ravenspur, in Yorkshire, bringing with him 300 Flemings, armed with hand-guns; this is about fifty years earlier than the date usually assigned for their introduction, many writers placing that event at the seige of Berwick in 1521.

The first English illustration of a hand-gun appears in the Royal MS., 18 E, fol. xxxiv., written in 1473. Reproduced is the illustration, which, however, has already appeared in "Hewitt's Ancient Arms and Armour." The drawing is not an explicit one; it fails to show the position of the touch-hole, or to explain in which way the gun was fired. As

the bearer carries neither flask or pouch, we presume he must have been accompanied by an attendant, who carried the accessories and applied the ignition to the arm. The position of the man is also very peculiar, and one not well calculated to withstand the recoil. The manner of grasping the gun is also original, and from the general

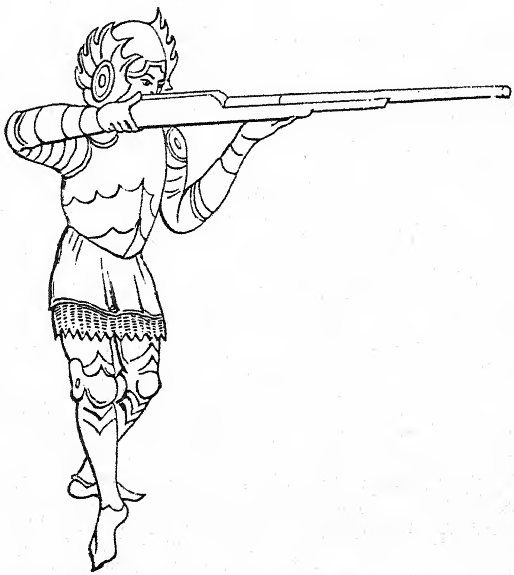


Fig. 31.—Soldier Firing Hand-gun, Fifteenth Century.

appearance of the drawing it appears to represent a soldier shooting a weapon of precision at a dead mark.

Guns upon their introduction, and more especially hand-guns, met with great opposition.

The French were perhaps the most bitter against them. One old French author says :—

"On ne faisoit point encore usage en France, en 1547, de cette arme terrible contre les hommes ; les François s'en étoient bien servis en 1338, pour l'attaque de quelques châteaux mais ils rougissoient de l'employer contre leurs semblables. Les Anglais, moins humains, sans doute, nous devancèrent et s'en servirent à la célèbre bataille de Creçi, qui eut lieu entre ces troupes du Roi d'Angleterre, Edouard III., qui fut si méchant, si perfide, qui donna tant de fil à retordre à Philippe de Valois,

et aux troupes de ce dernier; et ce fut en majeure partie à la frayeur et à la confusion qu' occasionnèrent les canons, dont les Anglois se servoient pour la première fois, qu'ils avoient postés sur une colline proche le village de Creçi, que les François derent leur deroute."

[Translation.]

"No use has yet been made in France, in 1547, of that terrible weapon against men. The French used it with good effect against some castles in 1338, but they would blush to employ it against their fellow creatures. The English, less humane, without doubt outstripped us, and made use of some at the celebrated battle of Creçy, which took place against the troops of King Edward III. of England, who was so spiteful and treacherous that he plagued Philip de Valois and his troops to the last; and the greater part of the terror and confusion was occasioned by the cannon, which the English used for the first time, and had placed upon a knoll near the village of Creçy, and to which the French assign their defeat."

When the celebrated Montluc made his first appearance in the field under Francis I., firearms were less esteemed than the cross-bow, and the characteristic remark made by him in "Michaud et Poujoulat" clearly shows his opinion of these new weapons:—

"I must observe," says Montluc, "that the troops which I commanded consisted of cross-bow men only; since at that time there were in our nation no soldiers armed with guns. Only three or four days before, six Gascon arquebusiers, deserters, came over from the enemy's camp to our army, and these men I kept with me, as I had the good fortune on that day to be on duty at the gate of the town. One of these men was from the Montluc estates. I wonder, however, that it could have been the will of Providence that this unlucky instrument should have been invented! I myself still bear about me the marks that it has left, which even now cause me to suffer much weakness; and have seen brave and valiant men killed with it in such sad numbers, and it generally happened that they were struck down to the ground by those abominable bullets, which had been discharged by cowardly and base knaves, who would never have dared to have met true soldiers face to face and hand to hand. All this is very clearly one of those artifices which the devil employs to induce us human beings to kill one another."

Immediately after their introduction, firearms were greatly dreaded by all classes, and Shakespeare humorously alludes to it in *King Henry IV.*:—

"And that it was a great pity, so it was,
That villainous saltpetre should be digg'd
Out of the bowels of the harmless earth,
Which many a good tall fellow had destroyed
So cowardly; and, but for those vile guns,
He would himself have been a soldier."

Henry IV., Act I., Scene III.

Gunshot wounds in these early days were considered to be all but necessarily mortal, which may be accounted for by the unskilful surgery of the times. Some of the recipes for the cure of gunshot wounds were, however, much more likely to prove mortal than the wound itself. The following is one given, but the precise details are wanting :—Take of oil and wine equal parts, inject them into a living dog, well boil the animal, and its flesh, together with the oil, wine, and other ingredients, form the application.

Most loudly did the armoured knights clamour against the use of fire-arms, for even their heavy armour could not be made proof against the heavy bullets, and it was not a usual thing for a well-armoured knight to be killed. A good suit of armour would generally repel the blow of an arrow or quarrel, and the horses, not so fortunate, being driven mad by the rage and pain caused by the thrusts of the rough barbed missiles, would rear and throw their riders ; but the doughty warriors would roll about for a time upon the earth, and then retire with only a few bruises to engage in the tilting match another day. In several battles about this time not a single knight was slain ; even when unhorsed it was difficult to administer the *coup de grace* to the valiant cavalier, for the *misericorde*, or dagger of mercy, refused to penetrate the chinks of a closely-jointed suit.

At the battle of Fournouë a number of Italian knights, being unhorsed, could only be killed after they and their armour had been broken up, like so many lobsters, with wood-cutters' axes ! Well might James I. remark that defensive armour was a double protection, preventing the bearer from being injured, or from injuring others. The belted knights were powerless against villainous saltpetre, and loudly they inveighed against such unchristianlike modes of fighting ; but public opinion overcame their prejudices, as it was apparent that warfare could no longer be carried on as a gentle pursuit.

Many of the doughty warriors, finding that war had become so rough a pastime, seceded from the ranks ; others grew accustomed to the firearms and took their chance. The musket, however, gave the *coup de grace* to their chivalry, and great was the innovation made upon its introduction, loud and deep were the anathemas of the knights, low the execrations and mutterings of the armourers, who perceived in the near future their occupation gone. The strength of armour was increased for a time, breast-

plates resembled the armour of an ironclad, helmets resembled iron cooking utensils; the horses could not support the enormous loads, and sometimes the knights were smothered in the fray. Thus the introduction of the firearm caused the overthrow of chivalry, knights were no longer the strength of an army, and the strong hand bowed to the

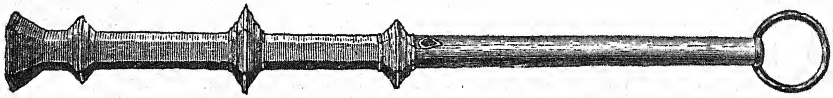


Fig. 32.—Iron Club Pistol of the Fifteenth Century.

genius of the gunmakers, who had caused such a complete and rapid overthrow of the ancient system of warfare.

To add to the terror of the knight, and for unexpected use at close quarters, a number of peculiar firearms were invented, consisting of a combination of a firearm with some other hand-weapon. Several descriptions of these arms are to be found in the various museums of Europe. Illustrated in Fig. 32 is a "Club Pistol" of the first part of the fifteenth century. It is wholly of iron, the barrel commencing just in front of the

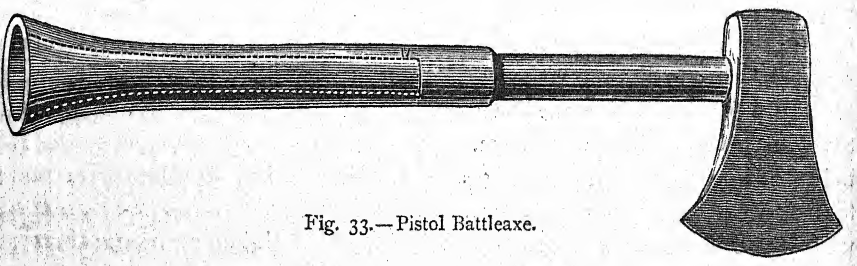


Fig. 33.—Pistol Battleaxe.

handle; the touch-hole is on the top, the pistol being held in one hand and fired by the application of a match from the other. It is about two feet in length, and has a heavy ring round the muzzle to make it more formidable as a club. Fig. 33 represents a Pistol Battleaxe of the Dresden Museum. It was used in the early part of the fifteenth century. In the illustration the interior of the barrel, and the shape and position of the touch-hole, are shown by dotted lines. In firing the pistol it was necessary to hold it near the head of the axe; but, later on, Battleaxe

Pistols were constructed in which the barrel passed through the head, and thus obviated the necessity for reversing the weapon. About the same time also appeared the English weapon called the "Holy-Water Sprinkle," Fig. 34, which consisted of a strong mace, the head of which was formed by four or more barrels joined and arranged in the same manner as the chamber of a modern revolver, and having upon the outside one or more spike-studded collars.

There was usually but one flash-pan having connection with all the barrels, the powder was placed in and fired by a match from the hand. In the illustration, the flash-pan is shown upon the top, and has a sliding cover attached to it, but it was sometimes placed upon the side.

The above three weapons were intended for horseback use. Pikes, swords, &c., combined with pistols, were manufactured for the use of the foot soldier, but they bear so great a resemblance to the above weapons that no further description will be necessary.

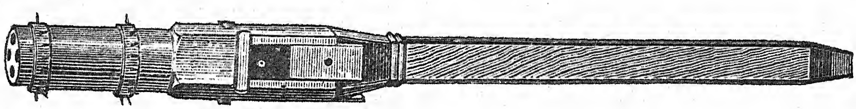


Fig. 34.—The Holy-Water Sprinkle.

The great drawback to all the firearms manufactured up to this time was the imperfect manner of igniting the charge, and the long time occupied in loading. The weapons were all exceedingly clumsy and unwieldy, tiresome to charge and discharge, and continually miss-firing.

Having discharged their weapons, a body of culveriners would be for the time defenceless. To remedy this, the culveriner was supplied with a sword, or the rest was converted into a defensive weapon, by adjoining a dagger, which was released by a spring. Such rests received the name of swines, or Swedish feathers.

The sword was too much for the early culveriner, for he had already too many encumbrances. Grose says that: "He had, in addition to the unwieldy weapon itself, his coarse powder, for loading, in a flask; his fine powder, for priming, in a touch-box; his bullets in a leather bag, with strings to draw to get at them; whilst in his hand were his musket-rest and his burning match."

The French culveriners, too, generally carried their lighted fuse at the girdle, until about firing, when it was wound round the right arm. With all these encumbrances, it is not surprising to find that the bow was for many years considered a superior weapon.

The culveriner was generally accompanied by an attendant, called a "varlet" or "gougat," to carry the rests and keep the fire going, a difficult matter in a shower of rain, unless, as was once the custom, the matches were carried in the hat. History states that great difficulty in retaining the fire was experienced by the English musketeers in the battle of Dunbar, 1650, which was fought during a dense fog, and a heavy fall of rain took place the night previous, to which the troops were exposed.

An extract from an old military work will give some idea of the powder, matches, and arms of the sixteenth and early seventeenth centuries. It is from the "Military Fireworks," by Kabel, published in 1619. The author says:—

"One of the greatest helpes consist in the pouther and match. For a souldier must ever buy his pouther sharpe in taste, well incorporate with saltpetre, and not full of coal-dust (raw charcoal). Let him accustome to drie his powder, if he can, in the sunne, just sprinkling it over with *aqua vitæ* or strong claret wine. Let him make his tutch powder, being finely sarsed and sifted, with quick-pale, which is to be bought at the powder-maker's or apothecarie's; and let his match be boyled in ashes-lie and powder, that it may bothe burn well and carry a long coale, and that will not falle off with touch of his finger. This preparation will at first touch, give fire, and procure a violent, speedy, and thundering discharge. Some use brimstone, finely powdered, in their touch powder, but that furs and stops up your breech and tutchole.

"The bullet of a souldier's piece must be of a just bignesse with the mouth of the same, so that, falling in smoothly, it drive down and close up the mouth of the powder. If the stock of his piece be crooked, he ought to place the end just before the right papp; if long and straight, as the Spaniards use them, then upon the point of his right shoulder, using a stately, upright pace in discharge. The musquet is to be used in all respects like the harqabuse, save that in respect it carries a double bullet, and is much more weightie. The souldier useth a staff breaste high, in the one end a pike to pitch on the ground, and in the other an iron forke to reste his piece upon, and a hole a little beneath the same in the staffe, whereunto he doth adde a string, which tied and wrapped about his wrest, yealdes him commodity to train his forke or staffe after him, whilst he in skirmish doth charge his musquet afresh with powder and bullet."

The difference between the musket and arquebus is here defined. At a later period, the light for igniting the matches was carried by a slow-burning fuse contained in a metal case perforated with small holes to

afford egress for the smoke. These fire-holders were usually attached to the girdle. All the early fire-arms were so slow to load that, as late as the battle of Kuisyingen, in 1636, the slowest soldiers managed to fire seven shots only during eight hours; and in 1638, at Wittenmergen, the musketeers of the Duke of Weimar shot seven times only during the action that lasted from noon to eight o'clock in the evening. It will therefore be evident that a more sure and quicker means of ignition was required. This was to some extent gained by the invention of the arquebus by the Spaniards, early in the sixteenth century. The arquebus was fired from a rest, and was constructed in various sizes. It had a longer barrel and a smaller calibre than the hand-culverin.

The great feature consisted in holding the match in a "serpentin" or cock (or rather, the prototype of what afterwards became the cock in a gun-lock). We give in Fig. 35 an illustration of an early matchlock.

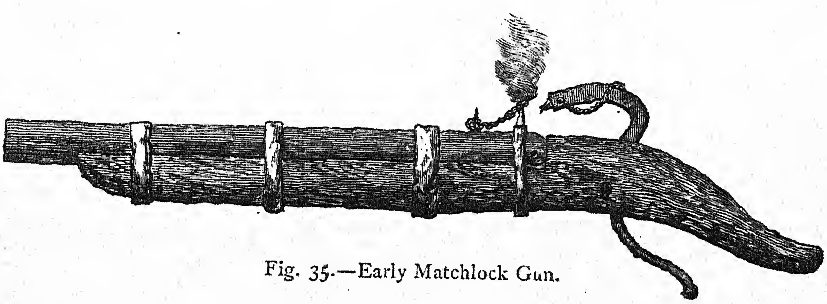


Fig. 35.—Early Matchlock Gun.

The slow match is kept burning in a holder on the top of the barrel; the flash-pan and touch-hole are at the side. The serpentin is hung upon a pivot passing through the stock and continued past the pivot, forming a lever for the hand. To discharge the piece, the match in the serpentin is first brought into contact with the burning match on the barrel until ignited: then, by raising the lever and moving it to one side, the serpentin is brought into the priming in the touch-hole, and the gun discharged—though it is highly probable the first arquebuses did not carry the fire in a holder on the barrel, but only the match in the serpentin.

The arquebus simple, as used by the Spaniards in 1525 when they captured Francis I. at Marignan, and to which the success of that battle

was due, was smaller than the arquebus above described, and had a simple lock and trigger. This arquebus, and the manner of shooting it, is shown in Fig. 36.

It will be seen that the serpentin is in the opposite position to that shown in Fig. 35. The flash-pan was closed by a hinged cover (*couvré bassinet*), that protected the primer from wind or wet. Before discharging the weapon, it was necessary to uncover the pan and blow upon the

Fig. 36.—Spanish Arquebusier of the Sixteenth Century.

smouldering match, to render the ignition more certain. The serpentin was at first pulled down into the flash-pan by the hand, afterwards by a lever, and then by a simple crank and a connecting-rod, to which the trigger was attached. A little later a spring was fixed to the lock, so that, upon being released by the trigger, the serpentin descended with considerable force, and obviated the necessity of blowing upon the match.

Fig. 37 represents a Matchlock with mainspring attached. The trigger, upon being depressed, causes the serpentin to fall into the flash-pan, the connecting-rod between the trigger and serpentin actuating a

crank to which the serpentin is attached. The mainspring, pressing against the connecting-rod, causes the serpentin to snap down immediately the rod has drawn the crank beyond the dead point.

The terms "hagbut," "hackbutt," "haquebute," "hackenbuse," and "arcquebus" are synonymous, and guns under these various appellations were used for several centuries in the armies of Europe, and did not disappear until after the invention of the flint-lock and hammer. Even at the present time this species of arm is in general use amongst the Chinese, Arabs, Tartars, and other eastern nations.

The Matchlock had many disadvantages, the greatest being the trouble experienced in retaining the fire. Early in the sixteenth century the *wheel-lock* was produced in Germany. The idea of the wheel-lock appears to have originated from the domestic strike-fires (flint and steel). The

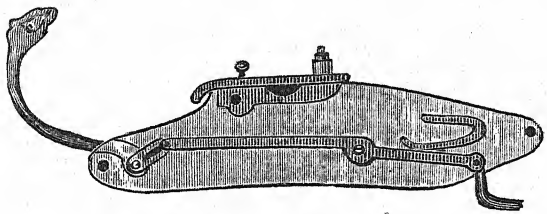


Fig. 37.—Mechanism of the Matchlock.

earliest attempt consisted in placing pieces of flint or pyrites (firestone, or compound metallic bodies, as sulphuret of iron) near the flash-pan, and producing sparks by the friction of a file rubbed against them.

In the Dresden Museum there is an example of this system in the celebrated "Monk's Gun." In the Royal collection of the Castle of Coburg there is preserved an old explosive cannon-ball covered with a description of pyrites, so that, upon striking the ground, the powder ignited and the shell burst. These balls are of an anterior date to the wheel-lock, and may have assisted in perfecting the crude idea.

The next improvement is shown in Fig. 38, which represents an early flint pistol.

The pyrites are held in the jaws of the serpentin so shaped as to form a strong spring upon the side of the weapon ; there is a guard underneath to assist the hand whilst gripping the pistol. The ring at the breech is

attached to a bar of steel with a serrated edge against which the pyrites press; the touch-hole is immediately in front of this pyrite; by drawing the ring sharply the serrated edge moves past the pyrites, and the required stream of sparks is thus obtained and the priming ignited.

The Wheel-lock proper was invented in 1515 at Nuremburg, and its mechanism was entirely different to anything constructed up to that date. Its parts were a grooved steel wheel with serrated edge, which worked partly in the flash-pan, and was connected to the back-plate by means of chain and strong spring, after the fashion of a watch-drum. The spring power was stored by winding the wheel up with a key or "spanner." In

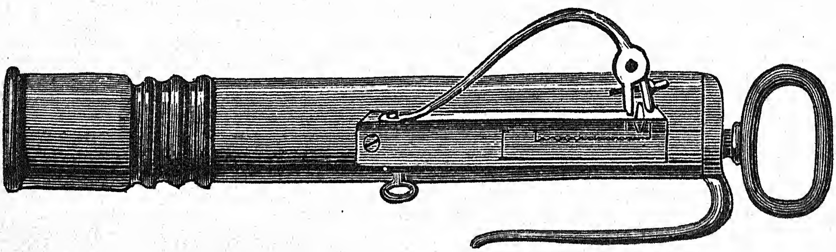


Fig. 38.—German Flint Pistol of the Sixteenth Century.

front of the pan a catch was placed, moved by a strong spring, and holding a pyrite with its jaws. When ready for firing, the wheel was wound up, the flash-pan lid pushed back, and the pyrites held in the cock allowed to come in contact with the wheel. By pressure on the trigger a stop-pin was drawn back out of the wheel, and the latter, turning round its pivot at a considerable speed, produced sparks by the friction against the pyrites, and thus ignited the priming.

The wheel-lock was further improved from time to time, especially about the years 1517, 1573, 1632, in Germany, and in Venice about 1584. The names of the celebrated "Georg Kuhfuss and Kaspar Rechmagel," gunmakers of Nuremburg, are associated with these improvements, to which were combined the removal of the pan lid, by pressing the trigger, and various safety bolts.

Fig. 39 represents the mechanism of the German wheel-lock: AA, is the lock-plate; BB, the wheel-drum; C, the axle; D, the serpentin holding

the pyrite, E, and kept pressing against the edge of the wheel, B, in the flash-pan, G, by means of the spring, F. The scear, and scear-spring, are arranged upon the opposite side of the plate. At first the scear simply withdrew from a notch in the wheel, but later, various complicated mechanisms were affixed; but they are not of sufficient utility to require a description. The scear was acted upon by a trigger in the usual way.

The wheel-lock gun was most expensive to manufacture, and was therefore confined in a great measure to sporting purposes and for use upon horseback, where it offered great advantages over the clumsy, but far less expensive, matchlock arquebus. With the introduction of the wheel-lock, the firearm came into more general use for sporting purposes; with the old-fashioned culverins, or hand-cannon, game could only be shot

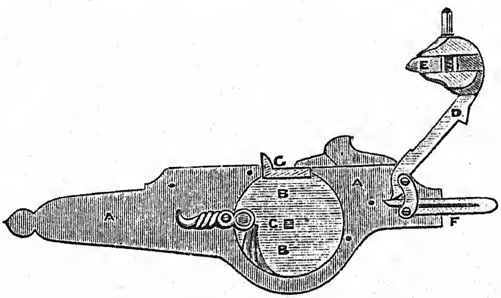


Fig. 39.—The German Wheel-lock.

upon rare opportunities, or by waiting *caché* until the unwary animals passed the sportsman, and it was altogether impossible to take a fine aim; with the wheel-lock a steady aim could be obtained; the guns were made lighter, and leaden bullets used.

The use of firearms for sporting and other purposes became so general towards the middle of the sixteenth century that a prohibition appeared in the state papers of the Elector, Augustus of Saxony, dated the 10th October, 1555, and in it the following passage occurs:—"Whereas the carrying of firearms in our dominions has become so general that not only travellers, but peasants and shepherds are found to use them."

Shot was also known at this period, for a Government regulation in the Duchy of Mecklenburg, dated 1562, runs thus:—"Hailshot we forbid the use of, entirely and absolutely."

It was about this time also that rifles became more generally known. Some German authors fix the date of the invention of rifled arms as early as the year 1440, but such accounts are doubted; but probably this date refers to barrels with grooves running parallel with the axis of the bore, that is to say without any spiral. Most writers assign the invention of spiral-grooved arms to Gaspard Kollner, gunmaker of Vienna, in the year 1498, though others state that his barrels had straight grooves, and that he first applied the system to arms for target practice at Leipzig. Other writers attribute the invention to Augustus Kotter, of Nuremburg, 1500 to 1520; but, however that may be, all seem agreed that the honour of the invention is due to the Germans. As a military arm, it was not adopted until the seventeenth century. In 1631, William, Landgrave of Hesse, had several companies armed with rifled carbines.

In 1641, the Elector Maximilian of Bavaria formed several regiments of horse to whom he gave rifled carbines, after which its use became more general. During the latter half of the sixteenth century it was adopted for the crack regiments of Sweden and France, and was also used by Frederick I. in the Seven Years' War. It was not adopted in England until the latter half of the eighteenth century.

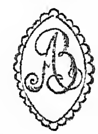
During the sixteenth and seventeenth centuries rapid strides were made by the Continental gunmakers in the improvements of their firearms. The ornamentation was superb, the mounting gorgeous and elaborate, the devices unique, the mechanism ingenious, and made with a wonderful amount of care and skill.

In the manufacture of the barrels the Spanish and Italian smiths excelled. The most famous barrel-maker of perhaps any age was Nicholas Bis, goldsmith to Philip V. of Spain. His lowest price for a single barrel was equal to £40 of that period. He did not, however, mount the barrels himself.

Amongst the Italians the names of Comminazzo and Lazarino stand the most prominent. Their early barrels appear to have been made from one broad band of metal rolled over a mandril, and the edges overlapped and welded together, the joint or weld being underneath the barrel when placed in the gun-stock. They were beautifully formed on the outside, with many squares and mullers. The majority appear to have been of small bore, and have had ornamented rings round the muzzles.

Several of the barrels carry gold stamps or marks of the makers. Appended are a few fac-similes :—

Stamp of Nicholas Bis ... ... 

" Migona, of Pistoja ... ... 

" Gabriel de Algora ... ... 

Most of the famous German barrel-makers affixed their names or initials to their barrels, and frequently the date also.

In the locks most beautiful designs and peculiar mechanism are to be found; but, though excellently forged, the lockwork is generally very rough, and hardly in keeping with the elaborately ornamented exterior. In the wheel-lock there was plenty of scope for the ingenuity of the smith, and complicated, and consequently proportionately useless, mechanisms and patterns were devised. The ornamentation and workmanship of these old arms sufficiently proves that the gunsmiths and metal-artists of those days were not deficient in talent or skill.

Fig. 40 represents a German rifle of the first half of the seventeenth century, in the Birmingham Museum of Arms.

This beautiful weapon is a wheel-lock musquet. The serpentin resembles the head of a griffin. The stock is richly carved with scroll designs, and the engraving upon the weapon, especially that of the lock-plate, is worthy of the highest commendation, representing a hunting party in chase of a stag. The barrel bears the stamp and name of the maker, I. Georg Dax in Munchen.

The wheel is inside of the lock-plate, and the pressing of the trigger causes the flash-pan (*couvré bassinet*) to slide back; a safety-bolt is also attached to this gun, which is actuated by a small pointed stud descending from the stock immediately in front of the

trigger. A bead-sight is affixed upon the muzzle, and a back wind-guage peep-elevating sight is placed upon the stock in front of the grip. This sight is exactly similar in construction to the one used during the first half of the present century by the late Mr. J. Purdey, and other English gunmakers. The excellent engraving upon this and other guns about the same period convinces us that the engraving was not executed by the gunmakers themselves, but by first-rate artists who

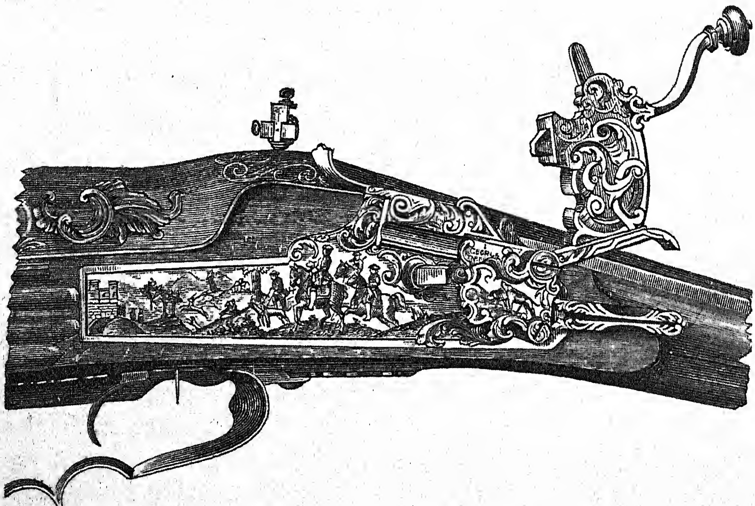


Fig. 40.—Ornamented German Wheel-lock Musquetoon.

gave their whole attention to the production and embellishment o works of art; and the carving of the stocks appears also to have been executed by expert professional carvers, and not by the gunsmiths proper.

In Fig. 41 is shown a similar gun. The engraving and carving is of a like character, but better in execution. The stock is inlaid with ivory and ebony in fanciful designs.

The engraving upon the lock-plate represents an army encamped. It is of a little later date than the preceding gun. The barrel is rifled, and the weapon appears to be of German manufacture, probably towards the end of the seventeenth century.

In the sporting arms of the sixteenth and seventeenth centuries it was the rule to ornament the stocks with various devices, and many wonderful and curious specimens of the wood-carver's art are found upon some of the battered stocks of the old weapons. Preserved in the Birmingham Museum are several guns beautifully ornamented with carvings and inlayings; one, a Turkish or Italian wheel-lock carbine, is

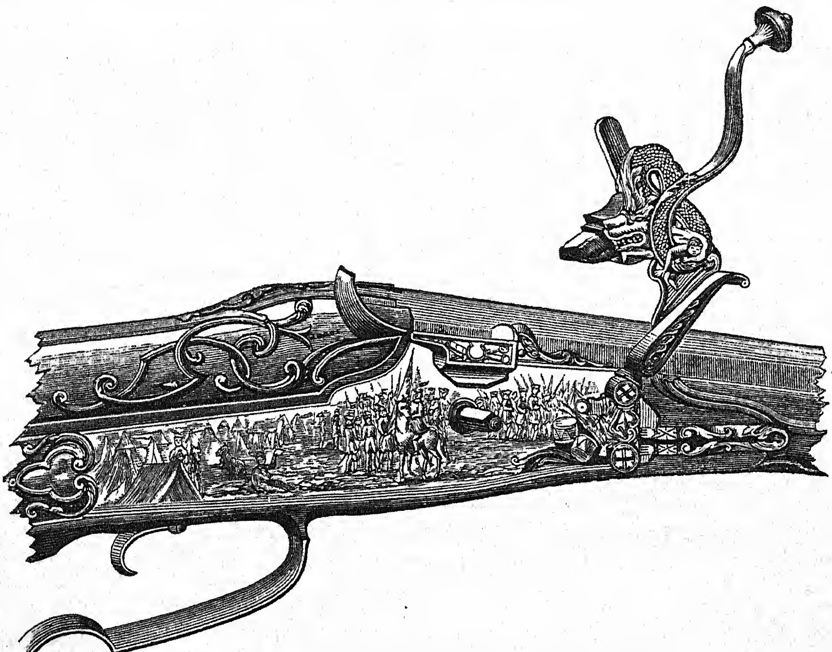


Fig. 41.—Ornamented Musket, Seventeenth Century.

splendidly inlaid with mosaic, representing flowers and foliage of various kinds; another, of ebony, is carved with curious designs of a combination of scroll-work with animals; another bears grotesque representations of jesters and fabulous monsters by way of ornamentation; but the crowning triumph of the wood-carver's art is to be found in the Paris Museum upon the stock of an Italian wheel-lock arquebus of the middle of the sixteenth century. The stock is skeleton, being pierced, and formed of perfectly-carved figures, which represent a nymph, seated upon

a goat, and holding by the hair a satyr, who has his hands tied behind his back. At the right and left of the breech are two infants carrying cornucopias. The forepart and groundwork of the stock is carved with splendid foliages, and the ironwork is fantastically chiselled to match.

The adjoining illustrations, taken from arms in the Paris Museum, will serve to show the styles of ornamentation at different periods. In Fig. 42 will be found an example of excessive ornamentation produced by carving in relief, the deeply-sunk hollows interspersed amongst the raised work having anything but a pleasing effect. In Fig. 43, representing a musquetoon with double wheel-lock, the ornamentation consists of inlaying the stock with metals, mother-of-pearl, and ivory. The devices consist of an odd medley of human figures, animals, foliage and scroll, but the general effect is much more pleasing than that shown in Fig. 42. Fig. 44 represents a matchlock musket that formerly belonged to the celebrated Cardinal Richelieu, and for the description of this curiously-shaped and remarkable weapon we cannot but translate the expressive words used by M. L'Haridon in the catalogue of the Museum:—"The barrel cut and squared towards the base, chased and gilt, exhibits three oval medallions, representing in relief warriors in ancient armour. The sight is formed of two rams' heads coupled together. The upper part of the barrel, formed like a fluted column, supports a capital in which are introduced four caryatides in full relief. The lock, decorated throughout with chasing on gold, has a head of Medusa in high relief. Beneath the gun-stock, which is of cherry-wood, is a boldly-sculptured figure of a dolphin. Above—where the barrel joins the stock—is a beautiful mask of a man's face surmounted by a shell; and on the shoulder-plate of the butt may be seen the three chevrons with a cardinal's hat, the armorial insignia of Cardinal Richelieu."

In the gun Fig. 45 will be found a beautiful specimen of a Venetian rifle of the sixteenth century. It has a wheel-lock in which the whole of the mechanism is arranged upon the exterior of the lock-plate, and may be easily understood by a reference to the engraving. The butt is of a peculiar shape, and has a box-trap covered with a sliding wooden lid. The guard is of an original pattern, but the trigger, the plainest feature in the gun, consists of simply a straight piece of wire. The stock, which is of walnut, is inlaid with gold, mosaic, filigree, and

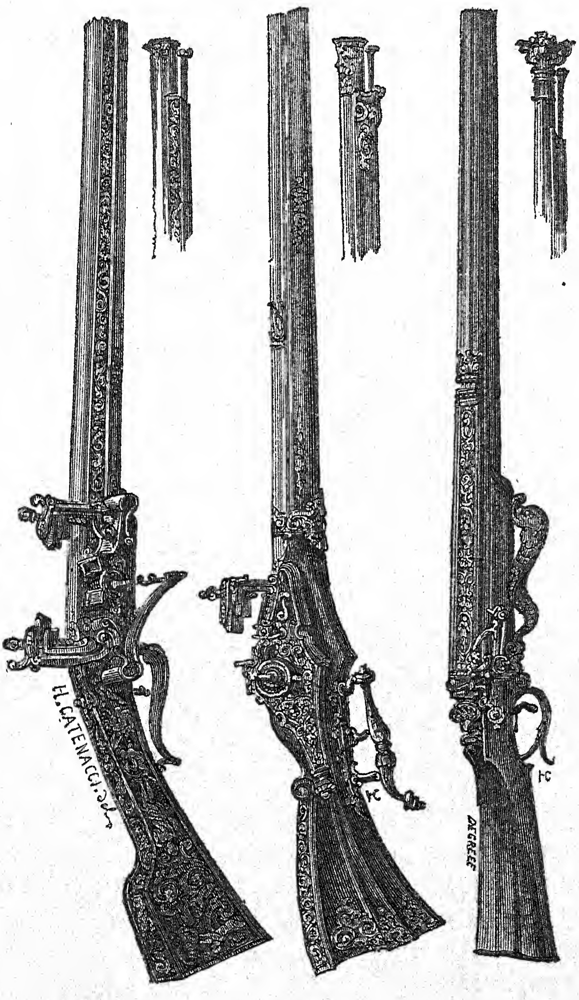


Fig. 43. Fig. 42. Fig. 44.

Ornamented Muskets

mother-of-pearl, and is as fine a sample of ornamentation as we have ever met with. The barrel is beautifully damascened and inlaid. It is bell-nosed upon the outside. The bore of the rifle, which is hexagonal, is very small, five-sixteenths of an inch. An end view of the muzzle is given in Fig. 45, and shows the enormous thickness at that part. The grooves are straight, but in other respects the bore is similar to the Whitworth.

The other representation, Fig. 46, is a view of an early hammerless gun. The body of the weapon is of brass chiselled. The hammer is fixed upon a hinge, and kept in position over the flash-pan by means of a spring; the flash-pan is at the base of the barrel in the body. The flint is fixed upon a rod working in the body, and actuated by a spiral spring to cock the gun. The flint is drawn back by means of the knob underneath the barrel, which is affixed to the rod in the body. There is a notch in the rod into which a scear engages. When the gun is cocked, and the hammer placed in its position, the gun presents no protuberances whatever, but is to all intents a hammerless gun. Even at this early date the advantages of having no complicated mechanism or ever entangling hooks upon the exterior appears to have been well appreciated, for in the Continental museums are preserved several high-class specimens of guns so constructed.

In the Paris Museum there are two, one differing in no respect to the one illustrated, but better made; the other is a breech-loader of Portuguese manufacture, and bears the inscription, "Fabrica-real, Lisboa, anno 1779." It is a breech-loader, all the mechanism being covered by a semicircular hinged lid. The mode of igniting the charge is by a flint and spiral spring, as already described. The barrel is fixed to the stock, the charge being inserted by the manipulation of the breech-plug.

These guns are provided with safety bolts which are caused to lock the trigger. They consist of a small flat metal lever hinged to the trigger-plate, and are provided with a slot or notch that fits over the trigger when the safety is moved half round. The two muzzle-loading guns are doubtless of German manufacture, the one in the Paris Museum is named "Johann Nereiter in Salzburg." They unfortunately bear no date, but judging from the style of ornamentation and shape of the butt, they were manufactured about the middle of the eighteenth century. These

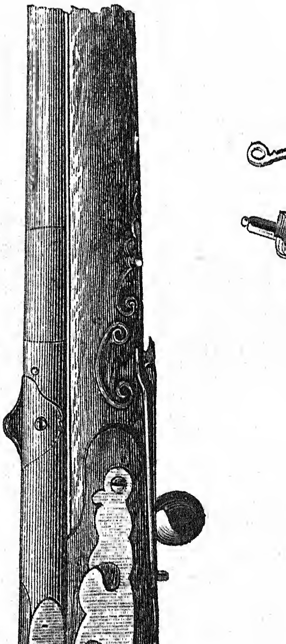


Fig. 46.
Ancient Hammerless Gun.

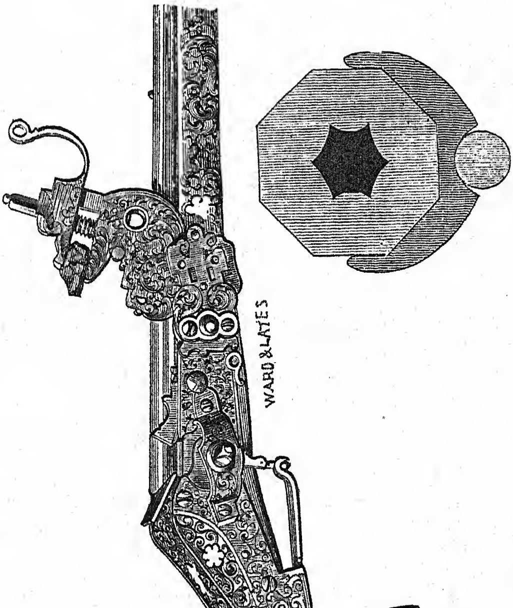


Fig. 45.
Venetian Rifle.

guns are highly ornamented and are all fowling-pieces, being much lighter than the ordinary guns of the eighteenth century. They were probably intended for wing-shooting, but could not have been made until several years after the invention of the flint lock.

FLINT-LOCKS.

The most reliable accounts state the flint-lock to have been of Spanish origin, and invented early in the seventeenth century, and prior to 1630. Immediately upon its introduction it was styled the Lock à la Miquelet, and so named, it is said, from a Spanish regiment composed of marauders (Miquelitos) of the Pyrenées; in which case the account of its

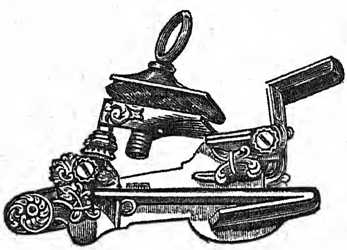


Fig. 47.—Spanish Flint-lock.

invention will correspond somewhat with that given by Grose and other English writers, who state the flint-lock to have been of Dutch origin, and first used by robbers, or rather poultry stealers (snaaphans), who, it is said, invented the flint-lock from a study of the wheel-lock, the use of the match-lock exposing them, on their marauding expeditions, to great inconvenience from the light of the priming-match showing their position, and they being unable to provide themselves with wheel-locks on account of their heavy cost. The flint-lock was called after them the Snaphaunce, under which name it certainly was known for many years in the Netherlands. Soon after their introduction the flint-lock guns were called fusils, from the flints (fucile), by a very common abuse of language, which consists in giving to an entire object a name taken from one of its parts. The flint-lock is so well known that it is almost unnecessary to describe its mechanism. The lock, however, when first introduced was not the highly-finished and

smoothly-working pattern of Joe Manton, but consisted of a mainspring upon the outside of the lock-plate that answered also for the hammer-spring, and had no swivel; the scear and the piece of metal answering to what afterwards became the tumblers, were fixed upon the inside of the lock-plate. Fig. 47 represents an early Spanish flint-lock taken from a gun in the Royal Collection at Dresden, and which, from the ornamentation upon it, appears to be intended for a sporting weapon.

In the flint-lock the hammer, or *cover plate* to the *flash-pan*, is knocked backwards by the blow of the flint screwed in the jaws of the *cock*, and uncovers the priming in the flash-pan, which is ignited by the sparks caused by the flint coming into contact with the steel face of the hammer.

The flint-lock was not readily adopted either in England or France. In the latter country the generals of Louis XIII. raised numerous objections to its use, saying—as was indeed true—that the sparks caused by the flint striking the hammer were not always sufficient to fire the charge, the stream of sparks going on either side of the pan, and failing to enter it. To remedy this fault *musket* fusils were constructed, which consisted of guns having a combination of both the flint and the match-lock.

In the year 1653, by an ordinance of Louis XIV., soldiers were forbidden to use flint-lock guns, and by another, later in the same year, the use of these guns by soldiers was made a crime punishable with death. They were introduced into England in the reign of William III., and from that time gradually increased in favour till they became the general weapons of this country. They remained in use in the British army until 1840, flint guns being manufactured in Birmingham for the English Government as late as 1842. Their use was continued in some of the continental armies later, and one European principality is still armed with the antiquated flint-lock musket.

The flint-lock gun, as a military weapon, after being adopted by the various European powers, underwent no very striking alterations. The pattern and efficiency of the lock was improved upon from time to time, and various plans were tried, to convey the smoke from the flash-pan and vent-hole away from the hands of the shooter, and several different systems for self-priming were introduced. In the guns constructed to obviate the gas and smoke at the flash-pan, it is usual to find a small tube running from the flash-pan partly, or in some models wholly, along the barrel, the lock-

flint and hammer, small in size, fit in a recess, and are entirely covered by a hinged or sliding lid. Several arms so constructed, and chiefly of German manufacture, are to be found in the Museum of Paris. The advantages gained appears to have been that the view of the shooter was not interfered with by the smoke, or his hand injured by the flash. In the self-priming guns the general system was to make a magazine of the hammer, having an opening at the base, so that upon the hammer being returned after the discharge, it deposited a sufficient amount of priming in the flash-pan, the communication being intercepted when the hammer fell upon the pan in position for firing. Some very good specimens of self-priming guns are to be seen in the Birmingham and Paris Museums, one of which is described and illustrated amongst the early breech-loaders. Another improvement consisted in a mechanical arrangement by which the hammer was caused to move over the flash-pan upon the cock being raised. This lessened the movements required to load the gun, and was effected by various means, a fuller description of which will also be found amongst the early breech-loaders.

In the combination flint and match-lock used in the 18th century, the match was held in a serpentin usually placed behind the hammer and facing the cock.

EARLY PISTOLS.

The advantages of having horse-soldiers armed with firearms were so evident that, upon the invention of the wheel-lock, weapons were constructed small enough to be manipulated on horseback, but not until the petronel had disappeared. This weapon, called the pistol, was first manufactured at Pistoia, in Etruria (from whence it obtained its name), by Camillio Vettelli, about 1540. The German cavalry called Ritters were the first to use the pistol with signal success, at the battle of Renty, fought in 1544, when they charged the French in squadrons fifteen to twenty ranks deep, and halted immediately on coming within range, each rank firing in turn and wheeling to the right or left, falling in again at the rear and re-loading the pistols. The manœuvre, called "caracole," was entirely new, and was at once adopted in the French army; and occasioned lances to be gradually but surely replaced by pistols. As first manufactured, the pistols had very short barrels and heavy, clumsy butts, nearly

at right angles with the barrel, and surmounted by enormous balls or caps. In a short time, however, the pattern changed, the butts being lengthened out, and almost in a line with the barrels. To all these early pistols the wheel-lock was the most applicable, and consequently we find the greater portion of the pistols of the sixteenth and seventeenth centuries fitted with wheel-locks. Short, heavy pistols called "daggs" were in common use about the middle of the seventeenth century. In some cases the butts were of ivory, bone, or hard wood, in others of iron or metal. There were various patterns in use, but the one shown in Fig. 48 will convey an idea

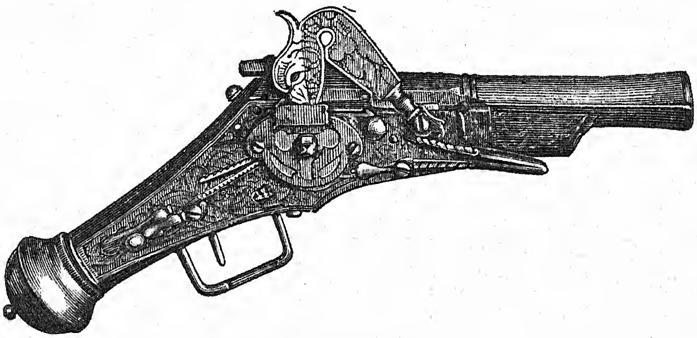


Fig. 48.—Italian Dagg.

of the general appearance of this weapon. The illustration represents a chiselled Italian dagg manufactured by one of the Comminazzo family about 1650. The barrel is slightly bell-nosed, about eight inches in length, and 14-bore. There is also a safety-bolt affixed on the right-hand side of the weapon, which is composed entirely of metal.

REVOLVING GUNS.

Before the introduction of the flint-lock various revolving match-lock guns were in use. The earliest description is an arquebus with four chambers, a specimen of which is to be seen in the Tower collection, and supposed to have belonged to King Henry VIII. It appears to be of the first half of the sixteenth century. This gun is represented in Fig. 49. The barrel is 2 feet 9 inches long, and the chamber 7½ inches, bore about half an inch. There is a separate flash-pan for each chamber, covered with

a sliding lid, and they are moved in succession underneath the serpentin. An end view of the chambers is also given. The barrel is fastened to the spindle, and strengthened by a rod fastened to its top, with the other extremity fixed to the butt of the gun. The lock mechanism is exceedingly simple, consisting of a serpentin pivoted in the stock, and extended below and behind the pivot to form a trigger. By pressing up the trigger the serpentin fell into the flash-pan, the weight of the trigger serving to bring it back into its place. Several similar weapons of a later date are to be found in the Paris Museum, of French and German manufacture. In one a spring is attached to the barrel, which engages in a stop in the chamber immediately it is in the proper position for firing. The chambers in all cases are moved round by the hand. One has eight, and another three, and the rest five chambers.

In one arquebus of the middle of the seventeenth century the fire is

Fig. 49.—Revolving Arquebus.

communicated to the chambers by one flash-pan only; but it requires re-priming after each discharge.

In the Paris Museum a three-chambered wheel-lock revolving gun is preserved. There is but one flash-pan, and the chambers are moved round by the hand after each discharge, and are kept in position at the time of firing by a spring button placed upon the tail-piece of the barrel. The date of these weapons is about the latter end of the seventeenth century. A six-chambered *flint-lock* pistol of the first half of the eighteenth century is also to be found in the same museum. The mechanism is similar to the preceding weapon, but it is self-priming, the magazine being fixed to the hammer or striking-piece, and upon being closed after each discharge deposits the priming in the flash-pan. The stock is finely carved, and ornamented with copper and filigree work. The lock bears the name "A. Leotien."

In the Birmingham Museum there is an Italian three-barrelled flint pistol of the latter end of the seventeenth century. In this pistol, illustrated in Fig. 50, the three barrels turn round upon one common axis, and are brought opposite the flash-pan by the hand. The barrels are arranged as shown in the muzzle elevation, which also shows the position of the wooden ramrod.

The pistol is well made, and by an ingenious contrivance the hammer or striking-plate closes whilst in the act of cocking. The spring catch for retaining the barrels in position at the moment of firing is released by

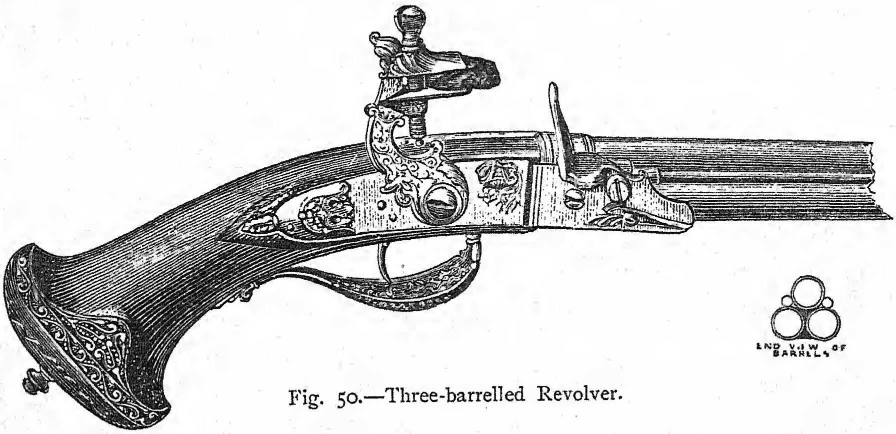


Fig. 50.—Three-barrelled Revolver.

pressing the trigger with the lock down. The pistol is neatly ornamented and mounted in chiselled steel, which, together with the shape of the stock, seems to indicate that it is of Italian manufacture. In the same museum there is also a revolving gun (Fig. 51). In this weapon there are two barrels, revolving upon a common axis, and each having its own flash-pan and hammer. One lock, cock and trigger, however, serves to discharge both barrels, they being turned in succession until opposite the cock and in the proper position for firing, in which position they are retained by a small spring bolt, moved by a stud fixed and working upon the fore-part of the trigger bow. This gun has a gold stamp upon the barrels, a fine scroll trigger, and the stock is beautifully finished and carved. From the shape and ornamentation of the gun the date of its manufacture can be

fixed as early in the eighteenth century, and probably of Milanese origin. Several weapons of similar construction are to be found amongst the various Continental collections, both private and public. In the Paris Museum there is a similar gun, but with four barrels, and two locks and triggers.

Revolving carbines were made upon the same principle, or with slight modifications, during the latter part of the eighteenth century, and various specimens are preserved in the various English and Continental museums. About 1810 a revolving carbine of unique description was manufactured in

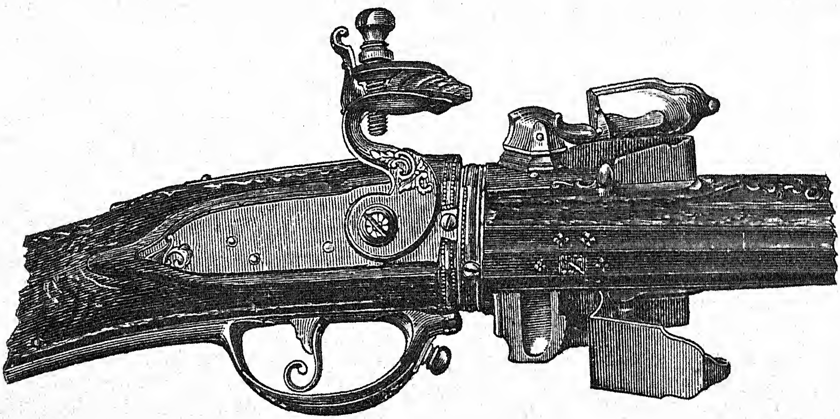


Fig. 51.—Double Revolving Gun.

England by E. H. Collier. This weapon is illustrated in Fig. 52. It will be seen by the engraving that the lock is placed nearly in the centre of the stock, the flash-pan and hammer upon the strap which connects the top of the barrel with the butt of the pistol, the touch-hole passing through the strap and into the chambers in an oblique direction. The breech is formed as a cap to the chambers, and in which their breech-ends revolve. This cap, by being always in contact with the outside of the chamber, prevents any escape of powder at the touch-holes. The chambers are revolved by the hand, but before turning they must be drawn backward about one-eighth of an inch, the chambers being slightly enlarged at their mouths, and fitting over the taper breech-end of the barrel; this ensured the axis of the chamber being true with that of the barrel during the

discharge. The chambers are forced over the tapered barrel by a flat spiral spring working upon the centre pivot, and are held up to their position at the moment of discharge by a small horizontal sliding bolt or lever, actuated by the trigger immediately it is pulled to fire the weapon. The arm is well made apparently, the only weak part being the lever holding the chamber up to the barrel during the discharge, which is too small to withstand the constant wear and strain of firing. The weapon represented has two barrels, interchangeable, one a rifle and the other a shot barrel: they are about 24-bore, and twenty-eight inches in length.

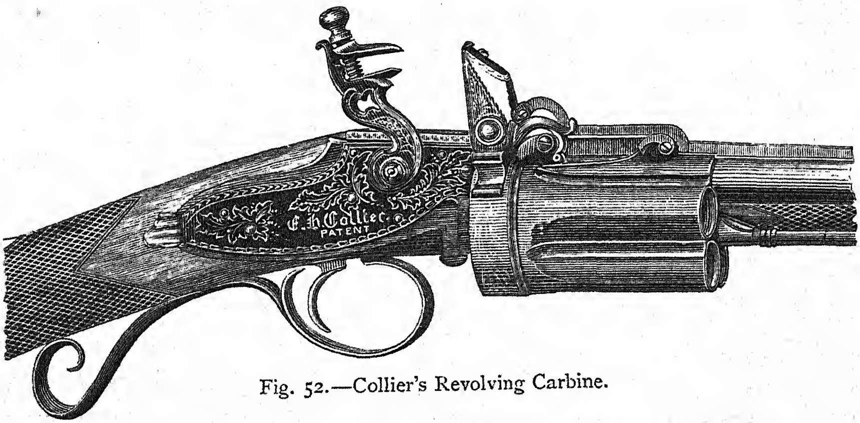


Fig. 52.—Collier's Revolving Carbine.

Weapons of similar construction by the same maker are preserved in various museums, and this system appears to be the last of note before the introduction of percussion weapons. In fact, a few years later specimens of this same weapon with self-priming mechanism for percussion ignition are to be found.

EARLY REPEATING ARMS.

The advantage of being able to fire two or more shots in succession with little delay was obviously felt at an early date, for we find many guns preserved in the museums with double, match, wheel or flint locks, and in which two, three, and sometimes more charges are inserted in the same barrel, one upon the top of the other, and fired in succession. The guns in which two charges are placed have generally two separate locks or touch-

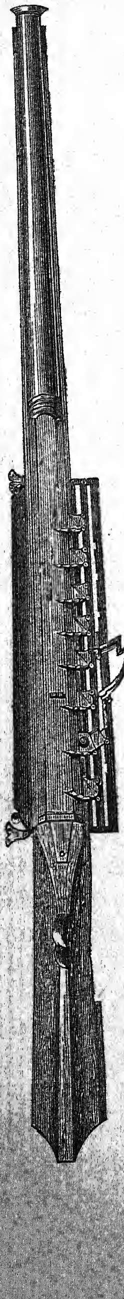


Fig. 53.—The Repeating Match-lock Rifle.

holes, but those capable of firing more charges have usually a mechanical arrangement similar to that shown in the annexed illustration, Fig. 53, which represents a match-lock arquebus capable of receiving and firing eight charges in the same barrel without re-loading. It will be seen that there are eight flash-pans, each protected by a hinged cover. The serpentin travels on a notched rack, and is brought into contact with the priming of each pan in succession, and fired by pressing a corresponding trigger. In loading the gun, each charge is separated from the other by two well-fitting leather wads or washers; but the use of such a weapon, if always loaded to its full extent, would be exceedingly dangerous.

Several other systems were tried during the seventeenth and eighteenth centuries, but, owing to their complicated and inefficient mechanism, they were not in general use either as military or sporting weapons. Their construction must, however, have called for considerable ingenuity and skill, for we find that by the sole motion of cocking the lock the charge of powder and ball is placed in the barrel, the priming in the pan, the hammer replaced over the flash-pan, and the various valves and apertures closed. The makers of these weapons appear to have been foreign without exception, and chiefly to have issued from Amsterdam, Hanover, or Liège. The peculiar complication of the various mechanisms, and the general inutility of the weapons themselves, render a detailed description of little value to the inventor or the general reader; but the connoisseur will find several varieties in the Paris Museum, which are comprehensively described in the valuable catalogue of the Museum, so carefully compiled by M. O. P. L'Haridon. We will conclude the few remarks upon this description of weapon by an illustration of an Italian flint-lock magazine arquebus of the eighteenth century, preserved in the Birmingham Museum. In this arm (Fig. 54) the powder

for priming and for charging the piece is contained loose in separate chambers in the butt, and inserted by raising the heel-plate. These chambers communicate with a revolving cylinder at the breech-end of the barrel, the axis of which is at right angles to that of the barrels. On the under-side of the revolving cylinder is a small aperture, in which the bullet is placed; the cylinder is then turned by the lever on the left side almost a complete turn. This movement cuts off and deposits in their respective places the proper charge of powder and the priming, closes the pan, and cocks the lock. It is, however, necessary, whilst so loading the arm, to depress the muzzle, in order that the powder

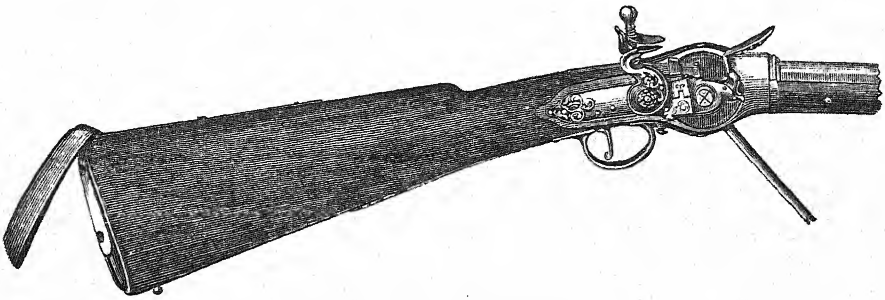


Fig. 54.—Italian Magazine Gun.

in the stock may fall into the rotating cylinder. This weapon bears the name of the maker, "Antonio Constantine," but unfortunately the date is wanting. It may readily be conceived that, unless the revolving cylinder is accurately fitted, the danger of using such a weapon must be great, the powder in the butt (sufficient for six charges) only being separated from the barrel by the revolving cylinder, which also acts as a false breech for the barrel; indeed the late W. Greener states that a pistol of similar construction blew up whilst being experimented with. A weapon of like construction to the above is in the Paris Museum; but the bullets, instead of having to be inserted each time by the hand, are contained in a recess under the breech-end of the barrel, and forced into the cylinder by a spiral spring.

The great difficulties to be overcome by the clever inventors of these early weapons were, the liability of the gas to escape into the magazine

and cause a wholesale explosion, fouling of the mechanism, and also having three different charges to place—viz., the powder, the bullet, and the priming. Modern inventors of magazine guns have not one-third of these difficulties to contend with, the priming, powder and bullet being contained in a *gas-proof* cartridge, causing a great simplification of the mechanism; and it is to the cartridge that the success of modern repeating arms is in a great measure due.

Of curious repeating arms no nation has preserved more numerous specimens than the Russian. Possibly Russian armourers have directed more talent toward the perfectionment of repeating cannon than to small arms, but both classes of weapons are numerously represented in Russian arsenals. As nearly all the systems differ in some essential particular it is a hopeless task to fully enumerate or illustrate them. At the date of writing—1883—no complete or illustrated catalogues of the St. Petersburg Arsenal have been issued, although both have long been in course of production. A personal visit has added to our knowledge of gunnery, the tact and ingenuity displayed on some of the more intricate mechanisms being truly marvellous in their diversity. It is regrettable that space will not permit of descriptions being given.

CURIOUS ARMS.

BEFORE the introduction of firearms, concealed arms for projecting missiles were extremely rare. In the Museum of Arms at Birmingham there is a small and curious crossbow of the early part of the fifteenth century, intended to be used as a concealed arm; it is about 10 inches in length, and constructed wholly of iron. The bow is double and armed by a fast-travelling screw; it is released by a small stud, which acts in the same manner as the triggers of the large arbalist, already described. This singular weapon when not armed lies in a sufficiently small compass as to be easily concealed in the folds of a cloak or tunic. Its range, however, cannot have been very great, and it was probably constructed to serve the ends of some private assassin. With the introduction of portable firearms, concealed weapons became more numerous; the surprise occasioned by the sudden discharge of a volley of unknown weapons caused more consternation and confusion than could have been gained by the actual killing or wounding power of the weapons themselves, The cavalry pistol when first introduced was considered a marvel of ingenuity, and won many battles for those troops who were the first to adopt it. There are firearms combined with battle-axes, pikes, swords, daggers, and even shields; but whether these weapons may be considered concealed weapons is a matter of speculation.

A purse, or sporran, of peculiar construction is preserved in the Museum of Edinburgh. It consists of an ingenious combination of the ordinary Highland sporran with a small flint-lock pistol hidden in the interior of the purse; by turning a succession of metal studs and buttons, when closing the purse, the trigger of the pistol is brought into connection with the clasp, so that any one unacquainted with the mechanical arrangement endeavouring to open the purse would cause the pistol to fire, with the possibility of wounding the intermeddler, or at any rate of considerably startling him, and perhaps causing him to relinquish the purse entirely as a remarkably "uncanny" article. The connection between the clasp of the sporran and the pistol-trigger is broken by reversing the action of the mountings, but which would appear bewildering to any

person unaware of their purport. The date of this sporran is placed about the seventeenth century; but Sir Walter Scott, in "Rob Roy," makes his hero the possessor of a similar sporran, the idea, it is said, having originated upon Sir Walter Scott seeing the above weapon in the Museum during a visit. The following extract from "Rob Roy" gives a good description of this purse:—

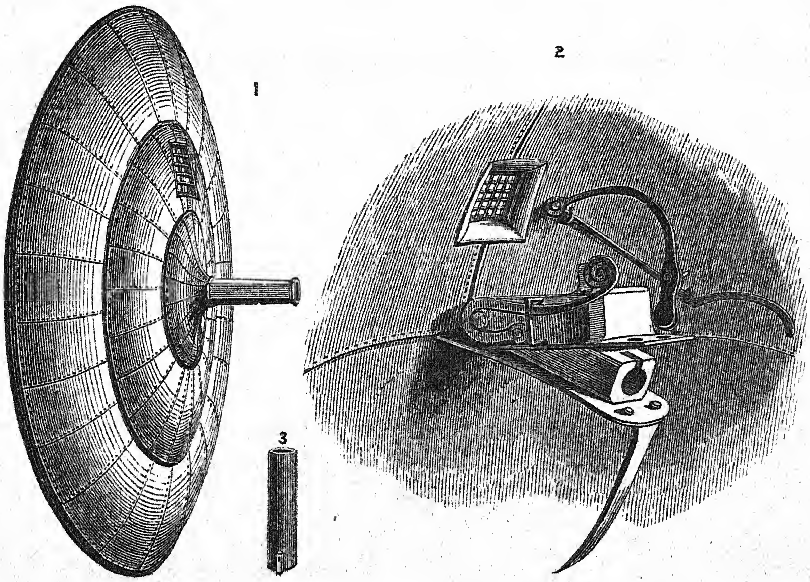
> "A tall, strong mountaineer, who seemed to act as Macgregor's lieutenant, brought from some place of safety a large leathern pouch, such as Highlanders of rank wear before them when in full dress, made of the skin of the sea-otter, richly garnished with silver ornaments and studs.
>
> "'I advise no man to attempt opening this sporran till he has my secret,' said Rob Roy; and then twisting one button in one direction, and another in another, pulling one stud upward and pressing another downward, the mouth of the purse, which was bound with massive silver plate, opened and gave admittance to his hand. He made me remark, as if to break short the subject on which Baillie Jarvie had spoken, that a small steel pistol was concealed within the purse, the trigger of which was connected with the mounting, and made part of the machinery; so that the weapon would certainly be discharged, and in all probability its contents lodged in the person of any one who, being unacquainted with the secret, should tamper with the lock which secured his treasure. 'This,' said he, touching the pistol, 'is the keeper of my privy purse.'"

The fallacy of so constructing a pouch is evident, for a rip with a knife would render useless the springs and accessories, and enable the robber to help himself to the contents without any inconvenience.

Amongst several interesting firearms of peculiar construction, and the combination of firearms with other weapons found in the various museums, a few are worthy of illustration. A weapon of unique construction is preserved in the Tower collection: it consists of a combination of a pistol with a shield or buckler. There are twenty-one specimens preserved in the Tower, all resembling Fig. 55.

They are circular in form, and have a breech-loading match-lock pistol fixed in or near the centre; the system adopted for loading consists of a block hinged upon each side of the barrel: it is raised up for the insertion of a loaded thimble or steel chamber. The match was affixed to a serpentin attached to a rod stapled to the interior of the shield, which was depressed by the hand into the flash-pan upon the top to ignite the charge. The mechanism will be more readily understood by a reference to No. 2, Fig. 55, which shows the breech of the barrel. 1 is the exterior view of

the shield ; and 3, the steel thimble or chamber. According to Hentzner, who noticed these shield-pistols during his visit to England in 1598, each pistol possessed four movable thimbles or chambers for loading and inserting in the barrel. There is a small barred aperture near the top of each shield through which an aim may be taken, and being bullet-proof they afford ample protection to the shooter from the missiles of his adversaries. These shields are enumerated in the inventory of King Edward VI. as target-



Obverse. Fig. 55.—Pistol Shield. Reverse.

shields with guns, and this, combined with their shape and size, should betoken that they were made about the first half of the sixteenth century. We believe this collection of shields to be unique, no such weapons being found in any of the Continental museums. Another curious combined weapon is to be found in the Paris Museum ; it consists in the combination of a sword with a short wheel-lock arquebus. The sword-blade is curved somewhat similar to a scimitar, the barrel being straight and forming a backbone to the sword-blade ; the lock is placed upon the cross of the

sword, and is discharged by pressing a small stud in the handle. The blade of this weapon is about 20 inches long, and is damascened and ornamented in a very artistic manner.

In the Tower collection a curious weapon is found in a pike and two pistols combined. The pistol-barrels are of cast metal and about 8 inches long; they are fixed about 4 feet from the head of the pike, and set at an

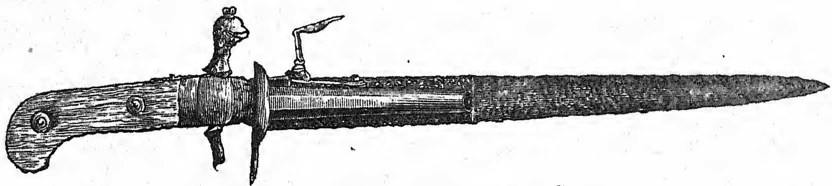


Fig. 56.—Dagger Pistol, Seventeenth Century.

angle of about 30° from the pike-staff; one trigger serves to discharge both barrels, there being a common flash-pan and a match-lock with serpentin.

In the Birmingham Museum are to be found several specimens of dagger-pistols. One of these curious weapons is represented in Fig. 56.

The pistol-barrel, which is about 4 inches in length, lies along the side of the dagger blade, and is discharged by pressing a small trigger in the handle of the weapon. The lock is a modification of the common flint-

Fig. 57 —Wheel-lock Dagger Pistol.

lock, the cock, hammer, and trigger-guard forming the cross of the dagger. Similar weapons with pistol on each side of blade are preserved in the same collection.

In Fig. 57 is represented another weapon of like construction; in this pistol the barrel is in the centre of the blade, a muzzle stopper being removed whilst loading and shooting the weapon. The muzzle stopper upon being replaced forms the point of the dagger. The pistol has a

beautiful wheel-lock and an ingenious safety-bolt, working upon the left side of the handle; the lock is discharged by pressing a small stud on the handle. The whole pistol is of steel, artistically ornamented, and the mechanism neatly and cleverly arranged, as may be seen upon reference to the illustration; the barrel is of Damascus iron. Another species of concealed arm is a whip-pistol, of which there is a fine specimen in the Birmingham Museum, having formerly belonged to a notorious Neapolitan brigand. The barrel is concealed in the whip stock, and runs its whole

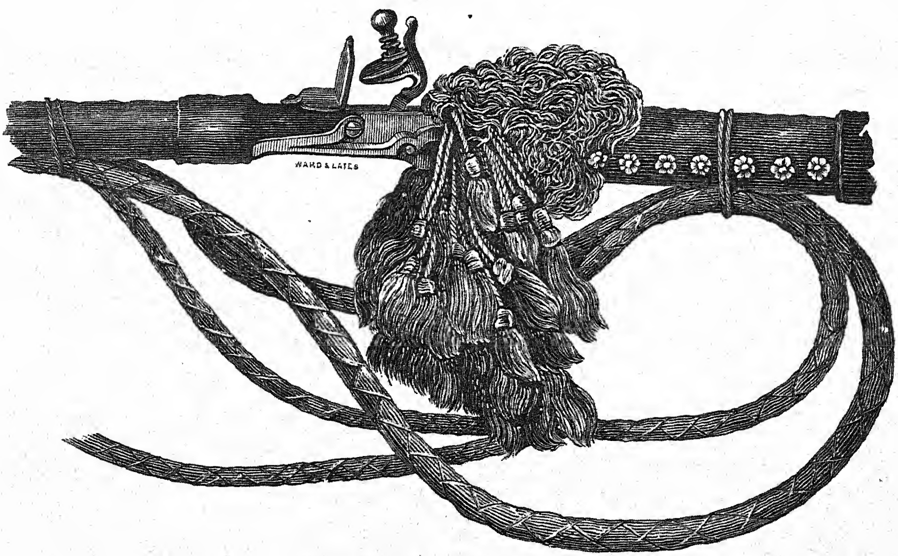


Fig. 58.—Brigand's Whip Pistol.

length, about 12 inches. The lock, a small flint and hammer one, is concealed by the ornamental tassels or fringe in front of the handle; it has a secret trigger.

The use of such weapons, however, was not confined to brigands and outlaws, for during the seventeenth and eighteenth centuries the postillions of the French mail coaches travelling south of Lyons were all supplied with similar whip-pistols, specimens of which are preserved in the Paris Museum.

In Fig. 59 is shown a peculiar battle-axe pistol of German manufacture. The barrel, which is only 6 inches long, is well concealed by the head of the

axe and the handle, nearly 2 feet 6 inches long. The weapon is fired by a wheel-lock, and the trigger is fixed near the extremity of the handle furthest from the lock. This weapon was probably intended for horseback use, and manufactured at the commencement of the seventeenth century. Various combinations of firearms with other weapons are occasionally met with, but they were not made in sufficient quantities to become general, which, indeed, would have defeated the object they were constructed for; and although they will always be regarded as great curiosities, the subject is not of sufficient importance as to render further details of any practical utility.

We shall, therefore, proceed at once with a description of a few interesting arms we have examined, and note some of the peculiar materials

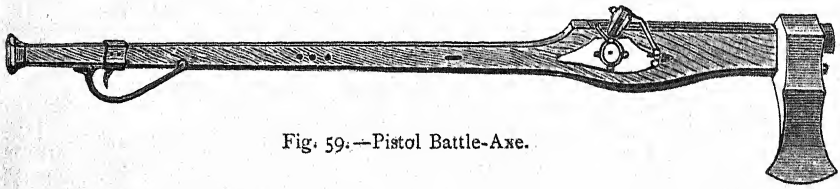


Fig. 59.—Pistol Battle-Axe.

and mechanisms that have been made use of at various periods by eccentric manufacturers. In Fig. 60 is shown a single hunting carbine of Louis XIII., a monarch who took great interest in the chase, and a portion of his interesting battery is still preserved in the Paris Museum. The shape of the carbine barrel is most peculiar, as will be seen from the cut. The barrel is apparently composed of two irregular tubes joined together. The object of so forming the barrel—which form is intended to represent the *Fleur-de-lys* of France—was meant as a delicate flattery to Louis. The bore is about $\frac{3}{4}$-inch from groove to groove, and the length of barrel about 4 feet 6 inches. In Fig. 61 we show a poly-grooved sporting carbine that formerly belonged to Napoleon I. This arm is double-barrelled, the barrels revolving on a common centre, and each carrying its own flash-pan and hammer. The shape of the butt is peculiar, and the ornamentation only ordinary. The barrel is considerably shorter than that of the carbine of Louis XIII., although heavier; the bore is about $\frac{5}{8}$-inch.

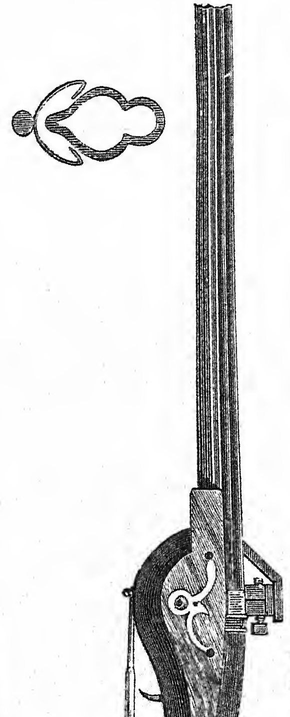


Fig. 60.—Carbine of Louis XIII.

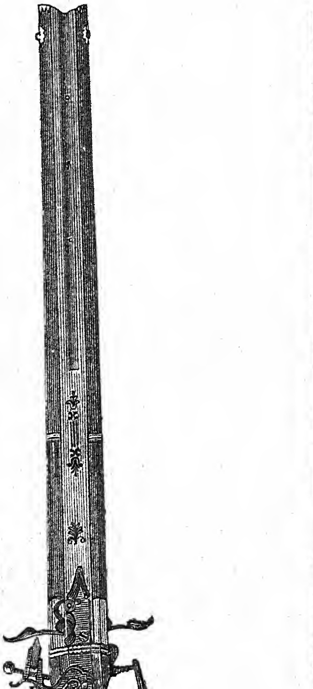


Fig. 61.—Hunting Carbine.

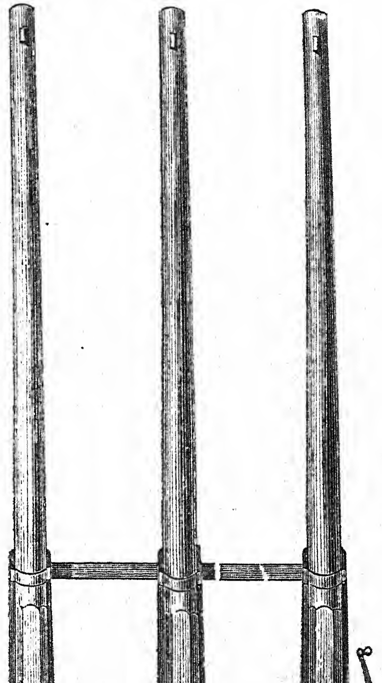


Fig. 62.—French
Wall Piece.

Amongst ancient wall-pieces we have met with several oddities. One is shown in Fig. 62, a wall-piece having three barrels to the one butt. The method of joining the auxiliary barrels to the main arm is very remarkable, though hardly calculated to withstand excessive recoil.

The barrels are fired by three separate flint-locks and triggers. The triggers are connected, so that the three barrels may be discharged simultaneously or in rotation. The length of the barrels is about 4 ft. 8 in., and the bore nearly 1 inch. The right-hand barrel is provided with a hook to aid in supporting the weapon at the moment of firing. For

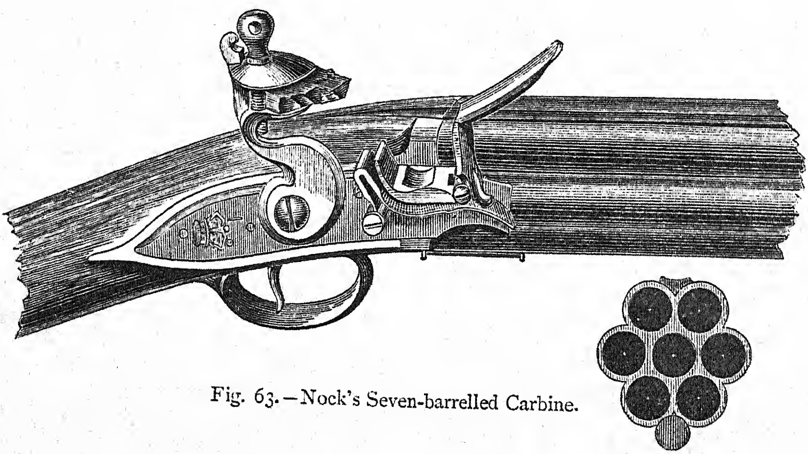


Fig. 63.—Nock's Seven-barrelled Carbine.

the defence of forts, citadels, &c., wall-pieces having six or more barrels were frequently constructed. The greatest number of barrels we have seen on one stock is ten. They were arranged unsystematically, and were all fired by one lock. Such arms appear to have replaced the ribeaudequin and kindred arms mentioned in the chapter on ancient artillery. They were very common in France during the eighteenth century, and were called "orgues" or "jeu d'orgues." Similar weapons were made for the British Government by Nock about 1807. Fig. 63 represents one of these arms. It consists of seven round barrels brazed together, and fired from a common touch-hole, all the barrels being discharged in rapid succession. The bore is about 20, and the

length of barrels 28 inches. They are not rifled, but are supplied with a top-rib, muzzle-sight, and ramrod. We also show end view of the barrels, to give a better idea of the clumsiness of the weapon.

During the first part of the eighteenth century, projects were on foot for supplying Grenadiers with mortars or arms for shooting the hand-grenades. They never came into general use, but many of these blunderbusses are still preserved in the museums. They generally consist of a short mortar of gun-metal two or three inches in diameter, and from four to eight inches in length. These mortars are affixed to long curved pieces of wood, one end being provided with a spike to stick

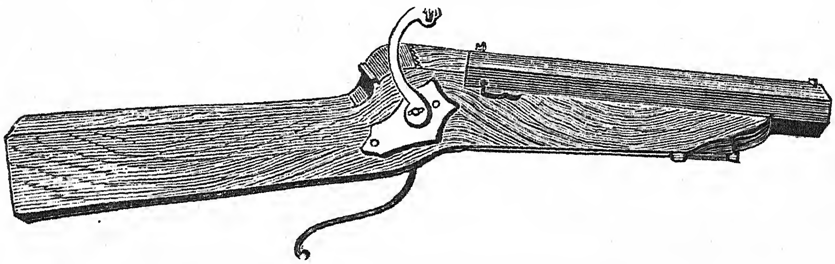


Fig. 64.—German Blunderbuss, Sixteenth Century.

into the ground. The mortars were fired by regular flint-locks and triggers in the usual way.

Amongst other curious weapons may be classed the domestic blunderbuss and ancient fowling-pieces. The first weapon of this description appears to be that shown in Fig. 64, and preserved in a German museum. It is supposed to have been made about 1510. The total length is about 30 inches, and it is fitted with back and foresight.

In blunderbusses the barrels are generally bell-nosed, some very much more so than others. Some have the noses flattened into the shape of an oval, evidently with the intention of scattering the charge. In many instances the barrels are wholly of brass or alloy, in others of iron, and in several the breech-end is of iron and the muzzle of brass. From these old weapons it was usual to discharge missiles of all kinds, but more especially slugs of iron and lead. The general form of the blunderbuss is so familiar as to require no illustration, and its chief end being

to create a noise, which the name thunder-burst denotes, any remarks as to its performance would be superfluous.

India-rubber strands have been applied to the locks of guns to act instead of steel main-springs, and weapons similar to toy spring-guns have been patented as military arms; crossbows having many india-rubber strands, which were strung in succession, have also been patented. In fact, an inspection of the various patent specifications reveals many oddities. In one instance a patent was granted for a simple lock, which consisted of placing the nipple and cap beneath the barrel, depressing the end of the ramrod, and allowing it to fly upward on to the cap.

In patenting a portable mountain cannon that was fired from a horse or mule, the inventor claims the placing of "india-rubber plates between the animal's hoofs and the shoes to lessen the shock of the recoil;" possibly the first anti-recoil *heel*-plate. A recoil-plate consisting of india-rubber rings fixed between the breech-end of the barrel and the stock was patented in 1855. In the same year, letters patent were granted for offensive and defensive equipment for cavalry. It was proposed to surround the horse with rigid frame-work, to which cutting edges and scythe-like projections were to be affixed.

The idea of firing a continuous stream of projectiles has frequently occurred to inventors, and many patents have been granted for inventions to effect this purpose. In some cases the propellant was steam, in others compressed air, the weapons being self-feeding; and in one case a self-acting breechloader is described, in which the reactive force of the "exploded gunpowder is made to set in motion self-feeding apparatus moved by the agency of water, steam, or air under pressure in such a way that the piece reloads and discharges itself rapidly."

Guns of various sizes have been so constructed as to take to pieces and stow away in a small compass, although the recent introduction of a large mountain howitzer that is composed of three pieces has occasioned general comment.

Leather has been used on many occasions as a material for constructing gun-barrels. The largest sole leather barrel we have seen was upon a pistol about 10-bore in the Paris Museum, and composed of three layers of strong hide sewn along the bottom of the tube and

not coiled. Leather-covered reeds and tubes have been in general use amongst Oriental nations, and gunpowder has even been used in a barrel composed of a single reed, though we should presume the only dangerous effect it would have would be upon the user. Many other curious arms and devices are to be found by searching the patent records and museums, several of them very amusing, but inutile, except to show that letters patent may be obtained for articles other than those destined to be of "general public utility," as the Patent Laws enact.

MANUFACTURE OF EARLY FIRE-ARMS.

A subject not without interest is the comparison of the arms of early makers; and although but little is known of the ancient armourer's handicraft, the specimens of his work show that he must have been possessed of cunning and skill. Of the tools for gun-making, save a few ancient ones encased at the Dresden Museum, none appear to have been preserved. Inspection of the inner mechanisms of early arms proves that their makers must have been wondrous smiths, and this art has for the most part been lost. Stamping and the accurate machine-shaping of later days have relegated to the hammer and stithy only the heavier and rougher shaping of the parts, and forging as an art is well-nigh dead. Conspicuous amongst nations for the solidity and ingenuity of their fire-arms were the German gunsmiths, and amongst no people at any time has the art of gun-making been more closely studied than by the German smiths of the seventeenth century. Numerous examples of their work still exist. Herewith are illustrated four "handbüchse," taken promiscuously from a case in the Dresden Museum. The upper one is a German rifle, the wheel-lock and hammer artfully concealed by the stag; the back sight is silver, the stock artistically inlaid with sporting and scroll designs, of a shape prevalent in Germany in the seventeenth and early eighteenth centuries.

The next is a wheel-lock sporting carbine, the well-curved stock being profusely ornamented by silver and ivory inlaying. The third rifle has the stock wholly of buck-horn, and doubtless was so constructed by way of novelty. It, as well as the two proceeding, is of Saxon

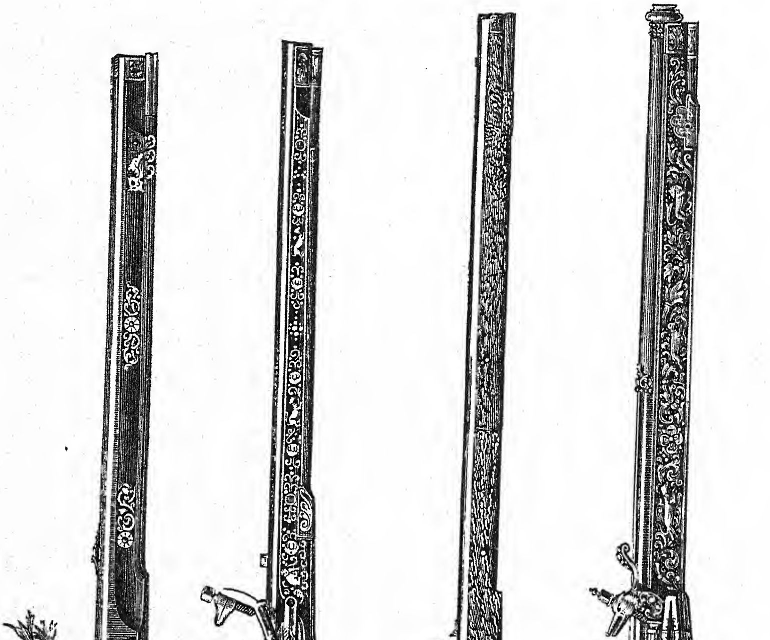


Fig. 65.—German Rifles.

make. Saxon pistols, too, of same date and style, are in the Museum, the stock of one some 18 inches in length being carved from one horn, and without a join, a rare sample of man's ingenuity. It would be tedious to enumerate the various materials of which gun-stocks have been constructed. Woods of almost every known kind, steel, iron, copper, silver, whalebone, ivory, leather, paper, and even straw, have each in their turn been used for the purpose of stocking. A remarkable weapon—the stock composed of many-coloured plaited straws—is in the Dresden Museum. The weight of the arm—a ball gun, the barrel 34 inches long—is barely 6½ pounds; the effect of the brightly-dyed straws is pleasing, and the numerous plaits are fixed, and the stock made rigid by a strong glue.

The last arm figuring in the illustration is an early South-German wheel-lock, the stock and lock both presenting ornamentation of a superior kind and worthy of emulation, the stock of that shape common in Italy as late as the early part of last century, and to this day the favourite of several Eastern peoples.

These arms show that not only was the strength of the arm studied, but attention also directed towards symmetry and artistic embellishment. Specimens of German ornamentation have already been shown (Fig. 40, 41) and remarked upon; but to make even more clear the talent and knowledge of these industrious artisans two other illustrations are appended, wood-cuts that have taxed the skill of our best engravers to produce. In these pistols the artists have given free play to their fancy both in shaping and ornamenting the stocks. The utile limbs, especially the trigger and its guard, exist in the cruder forms, a curved bit of wire, or a bent metal ribbon serve as limbs, which in later days have exercised the fancy of the leading gunsmiths of Europe: the shaping of triggers and guard being now esteemed is of almost equal importance as the lay and shape of stock.

The pistols of the German Ritters, with their balled stocks, so well known to frequenters of arms museums, were built for Grafs and Dukes, and ornamented so profusely that photography alone can adequately reproduce the beauty of their intricate details. For chiselling, carving, and *schnittwerke* they cannot be surpassed: the designs are originally conceived and admirably executed. The interior work is likewise good,

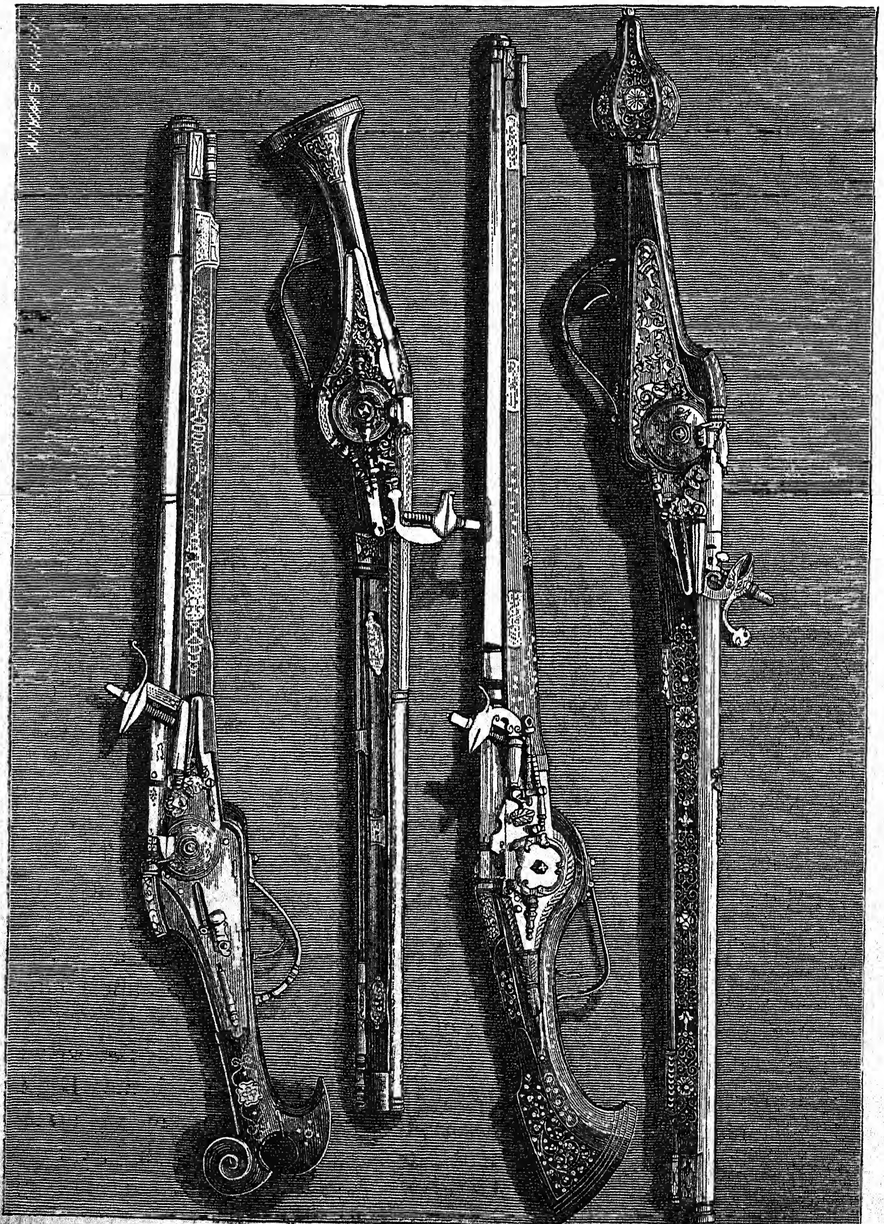


Fig. 66.—Old Saxon Pistols.

Fig. 67.—Old Saxon Pistols.

especially the smith's; but the interior finish of the lock limbs would be considered rough at the present day.

Passing for the time from German work, and reviewing the productions of Italy, the work of the smith is equally noticeable. Accuracy of forging is a characteristic of the productions of Italy's best gun-makers, added to embellishment of the most costly kind. Engraving, chiselling, inlaying and filigree work of skilful finish and artistic design, is the chief demarcation of Italian from German work. An excess of ornamentation was perhaps the leading fault, but Figs. 45, 48, 67, betray no such lack of design or perspective as is visible on some few arms treasured as the best work, of renowned German artists. On one of these, made in Dresden in 1658, is a representation of a female shooting with a wheel-lock at an animal that would pass equally as a sheep, bear, or megatherium, save that it is larger than a four-turretted castle in the foreground. In those days, as now, there were gun-makers *and* gun-makers.

Great rival smiths to the Italians were the Spaniards, and their barrels were for many years sought after by the leading gun-builders of all nations; indeed, the wonders of true forging have never been more ably exemplified than in the barrels of Nicolas Bis. In France the beautifying of arms was left for later dates than the early masters of Italy and Germany. Fine guns were built in France, following, for the most part, Italian models, but the larger percentage of foreign arms in French museums indicate that the early talent for gun-work was outside France. Belgium in the seventeenth century was not particularly renowned for small arms. Cannon, early in Europe's history, were made in Flanders, but it was not until the eighteenth century that Belgium and England took the van in developing fire-arms for sporting purposes. Lisbon and Copenhagen have possessed clever gunsmiths, and museums somewhat unfrequently testify to their workmanship; but the Italians, Germans, and Spaniards were the first to enjoy the popularity the perfectment of weapons ensures.

With Augustus III. and his westerly peregrinations and sporting proclivities, the manufacture of fire-arms at Cracow was fostered; and guns of considerable ingenuity, but of no great beauty, have successively been turned out from the smithies of Poland.

In Russia the gun-maker's art—as most arts—was scarcely practised until the day of Peter the Great. This enterprising monarch so developed the resources of Moscow's arsenal that it not only turned out serviceable weapons for the troops, but arms of passing beauty and richness for majesty and his nobles. Of the former many samples are extant, relics of Poltava and the siege of Troitska, when the monks defended their monastery by using these Muscovian flint-locks. Of the latter several are carefully guarded in the Kremlin, and a sample of these is here shown. Its richness and profuse ornamentation almost beggars description: ivory, mother-of-pearl, gold, stones, and stained woods are lavishly bespattered over stock and barrel alike. The lock is a clever piece of Russian fret-work, and a queerly-cut inscription states that the gun was built for the Tsar, Alexis Michaelovski, in 1654. This arm has no less than three band-swivels, and all on the front part of the stock. The shape of the barrel is shown in elevation, as are also the lock and foresights, which are of gold. B is an ordinary old Russian flint-lock, and guns very similar may still be bought as usable commodities in the rag-markets of Moscow, or the annual fairs at Nijni and Irbite; C represents a more elaborate weapon of Muscovian make—a Russian wheel-lock rifle—it is built after the German style, but lacks any shape in the butt.

Arms with locks on the principle shown in A, but with an octagonal stock slightly bent, are still largely in use amongst the Tartars, and are common enough at Oranienburg, Russia being far behind western countries in this respect. Nevertheless, the arms museums of Russia are without equal for completeness, and diverse systems both of cannon and small-arms. The Kremlin at Moscow, the Monastery of Troitska, the Museum at Tula, and the royal collections of St. Petersburg and the Zarskoe Selo, contain more devices in arms mechanisms than would seem conceivable. They have never been properly catalogued, though a certain arrangement has been followed. The St. Petersburg collections are rich in combined arms and revolving and repeating guns and cannon, all of which, however, appear to have a greater antiquity than they in reality possess. The two revolving arms here shown are but types of endless varieties in revolving field pieces. The early "Ribeaudequins" and "Orgues de Bombardes,"

Fig. 68.—Arms made in Moscow Arsenal.

already described, lived again in Russia during the last century, and such "orgues" even exist having barrels capped and nippled as the later percussion arms. These arms exist in considerable numbers in Russian museums, as do also cannon of various breech-mechanisms, on screw, movable plug, and wedge systems. These systems, for the most part, were the production of the eighteenth century.

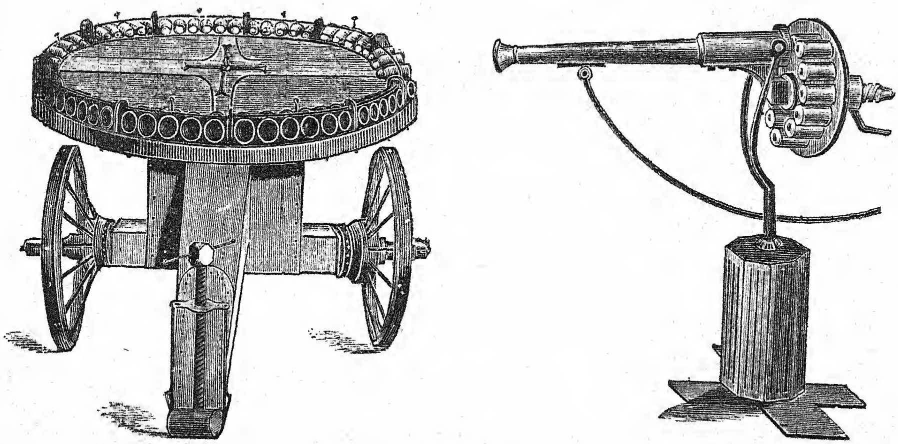


Fig. 69.—Revolving Arms, Russian.

Of combined hand-arms, guns, and pistols, with pikes and pistol-clubs, there are comparatively few relics in Russia. German craft seems to have devised the more varied styles of these arms. In the superb collection of the late Prince Karl of Prussia are numerous examples of the armourer's arms applied to such weapons. A sword, with a back-bone formed of a gun-barrel tube, and a small wheel-lock on the hilt, is one of the more rare. Dagger-pistols of various makes, sizes and systems, and one of somewhat late date, is here illustrated. The method of fixing the barrel to pistol is crude, and the utility of the broader part of the dagger-blade is nullified by its proximity to the hand. If only meant for thrusting purposes, it is truly a cumbrous arrangement. Far more deadly useful is the pike alongside it. It is of earlier date than the flint pistol, probably of the early sixteenth

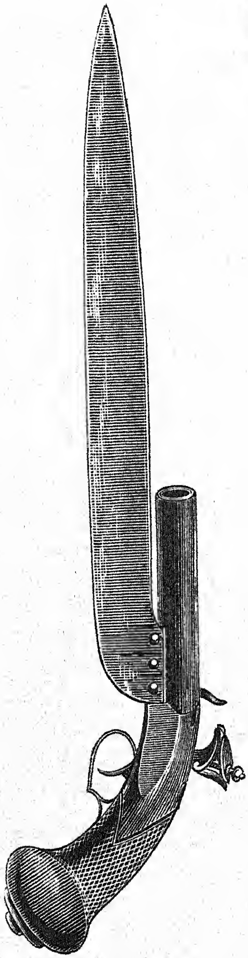


Fig. 70.—
German Dagger-Pistol.

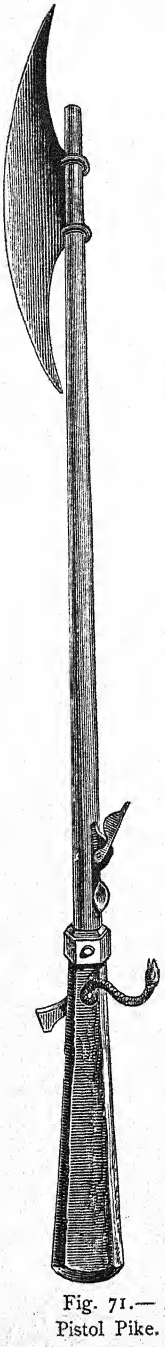


Fig. 71.—
Pistol Pike.

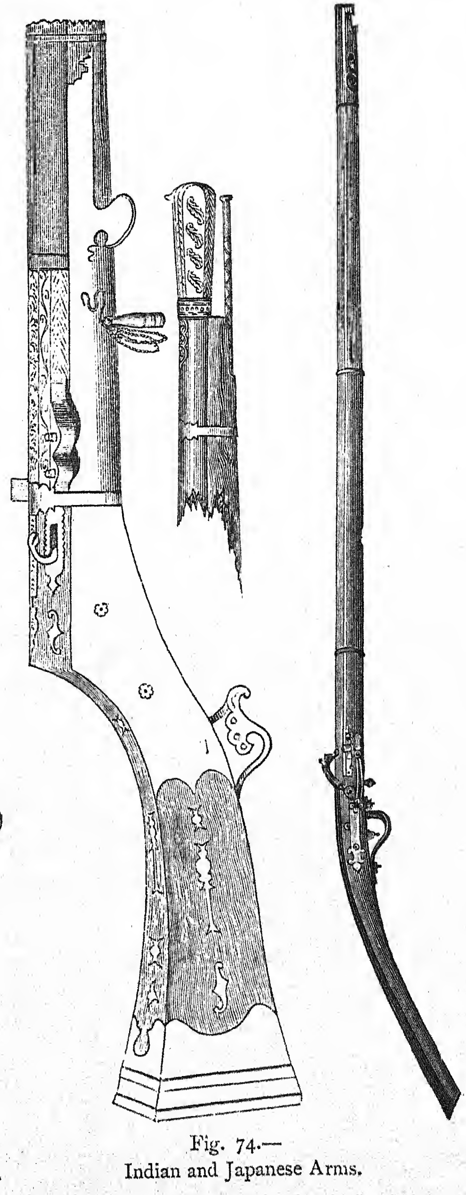


Fig. 74.—
Indian and Japanese Arms.

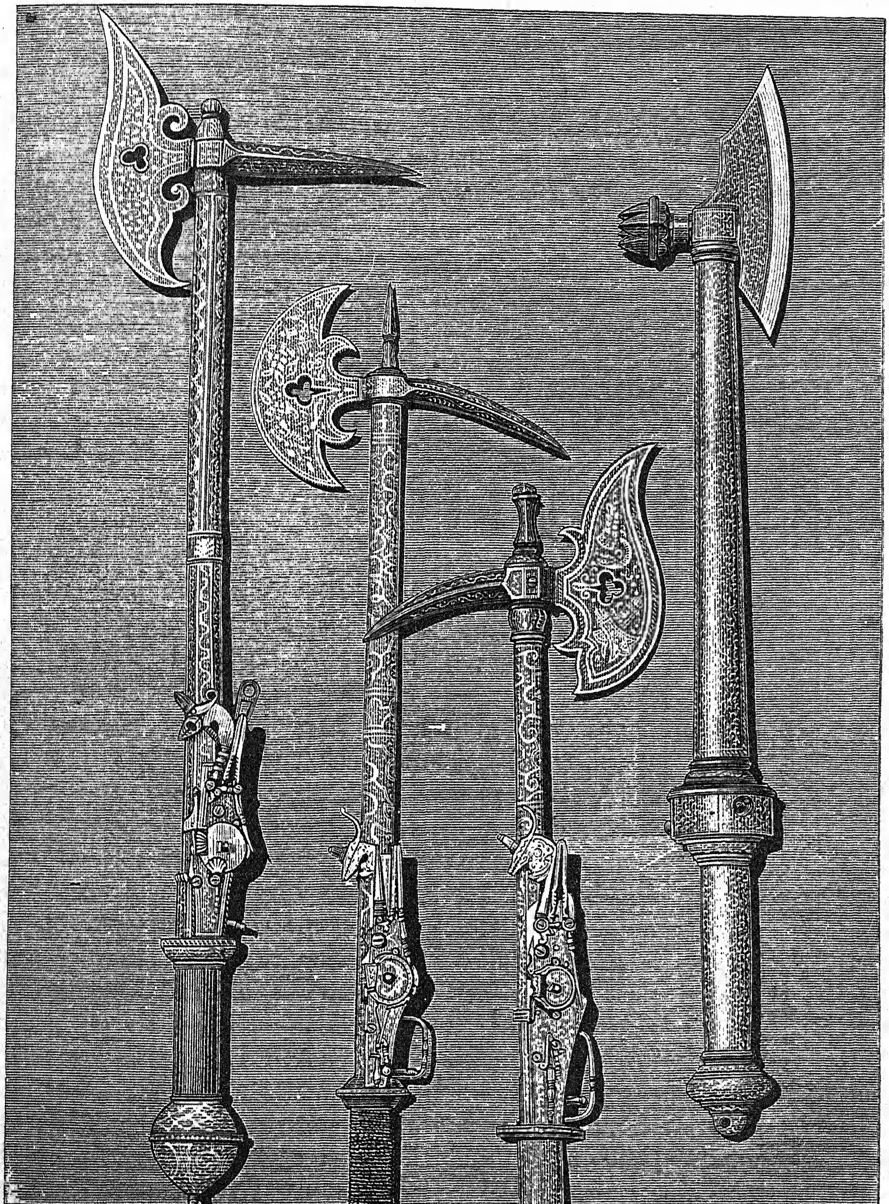


Fig. 72.—Saxon Battle-Axes.

century, and available alike for thrusting or hacking purposes. The barrel is of iron, nicely tapered, the blade of tempered steel, the stock of yew wood, and it may be the earliest combination of a fire-arm with the halbert. The Dresden collection is particularly rich in these last-mentioned combination weapons, so also in pistol battle-axes. The plate given will convey some idea of the perfection of the smith's and acid-etcher's art exemplified in these handsome old arms. The wheel-lock, the most convenient for concealed weapons of early days, was the system to which nearly all such weapons were restricted. The fourth club, which is of earlier date, has merely a touch-hole and revolving *cœuvre bassinet.* The particulars of an arm of much later date have been kindly volunteered by E. A. Elliott, Esq., through whose courtesy a representation has also been placed at our disposal. This battle-axe is of bronze. Its construction will be seen at a glance, the dotted lines indicating the bore of the barrel tube. It was captured by a gentleman in the Bengal Civil Service from the Luntals, a hill tribe. The thickness of metal at muzzle is only one-fifth inch, and the weight 1 lb.; its length over all is 16½ inches, of which the pistol-barrel takes 8½ inches. The weapon has been much used, and is so like the early fire-arms of Europe already described, as to be additional evidence of the unity of thought pervading the whole human race.

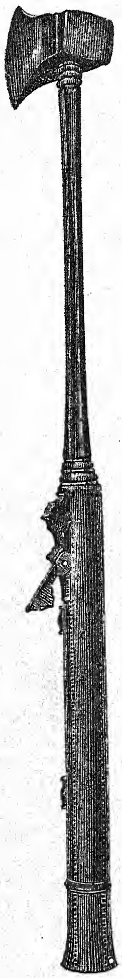


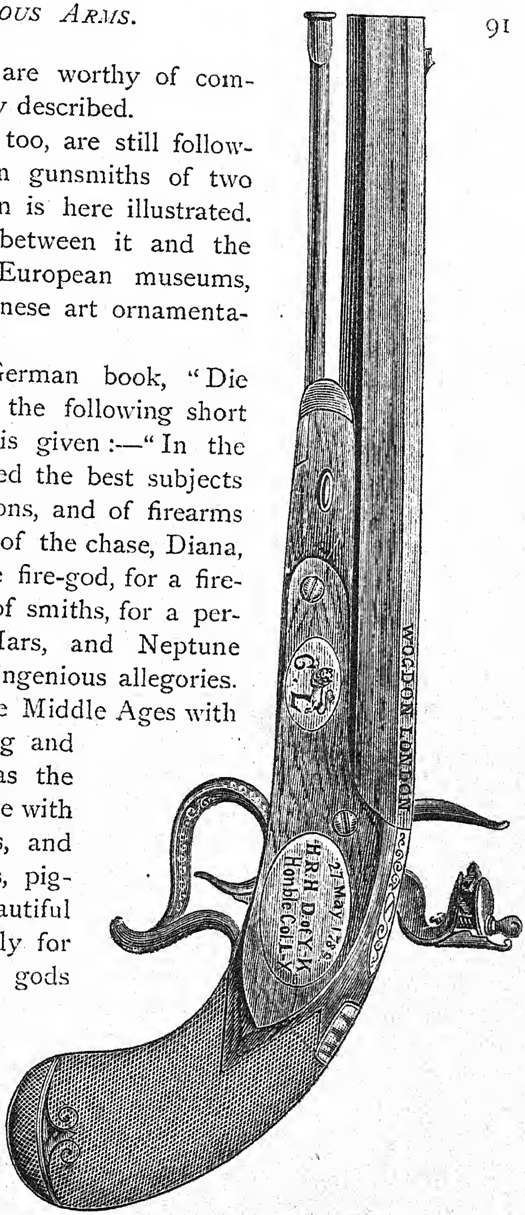
Fig. 73.—Modern Hindoo Battle-Axe.

Something, too, following the same line of argument might be made out of a comparison of the shapes of the guns, especially the stocks of present Eastern arms, and the ancient European ones. The one now shown is a beautiful specimen of Hindoo workmanship, and was presented to the Prince of Wales by an Indian Rajah when the Prince made his Indian tour a few years ago. The gun is heavily jewelled and excessively ornamented according to Western tastes. The shape of the

stock and style of mounting are worthy of comparison with earlier arms already described.

The Chinese and Japanese, too, are still following the track of the European gunsmiths of two centuries ago. A Japanese gun is here illustrated. There is but little difference between it and the earlier culverins preserved in European museums, save, of course, it has the Japanese art ornamentation.

In a recently published German book, "Die Moderne Gewehr Fabrication," the following short history of gun ornamentation is given:—"In the earlier times Mythology furnished the best subjects for the embellishment of weapons, and of firearms more particularly. The goddess of the chase, Diana, for a sporting gun; Vulcan, the fire-god, for a firelock; Vesta, as tutelar goddess of smiths, for a percussion gun; whilst Venus, Mars, and Neptune supplied other needful and very ingenious allegories. Ancient stories also furnished the Middle Ages with ample designs for both chiselling and engraving the gun. Thus it was the fashion to ornament the lockplate with dragons, serpents, tigers, griffins, and leopards, and finally with devils, pigmies, and other comical and unbeautiful figures. Afterwards, and certainly for a long time, were devils and gods wholly ignored, and the ornamentation confined to representations of sporting scenes and game with various foliage, and scroll-work combinations, which style originated in Paris and gradually extended over Europe." The work of the Parisian artists



A Notable Duelling Pistol.

upon early arms shows careful execution and harmonious designing. The art of chiselling and encrusting has not been lost, and quite recently Parisian gunmakers have built arms surpassing in beauty of design and accuracy of work any treasured in museums, and with embellishments even more lavish and thorough. Parisian workmen have long been and remain unequalled for work of this nature.

Duelling, when and wherever in vogue, has caused the production of weapons most accurately made and reliable at twenty paces, good specimens of the gunmakers' craft at their date of manufacture. The pattern of pistol seldom varied, and for exterior appearance and handling the duelling pistol of to-day is the same as that of last century. The specimen here shown, a very good one of its class, was recently through our hands. It has figured in several memorable contests, the better known encounter being that between His Royal Highness the Duke of York and the Honourable Colonel Lennox in 1789. The little meeting took place on Wimbledon Common, and His Royal Highness, who did not fire, lost a curl by his adversary's shot. The accuracy of this pistol is equal to that of more modern ones, the same principle of a heavy bullet and a small charge of powder being employed.

This hasty *resumé* of the gunmakers' art in its early days shows that the craft was by no means a despicable one; that ingenuity, cunning, fancy, dexterity, and plodding perseverance, were taxed to produce and to perfect the sporting as well as the military arm, and that then, as now, high-class work was esteemed and sought after.

DOUBLE GUNS.

The double-barrelled gun is essentially a sporting arm, not that it is unsuitable for military purposes, but because a quick second shot at game is often most desirable, and lends an additional charm to shooting upon the wing.

The first double-barrelled arm was, in all probability, designed for a military weapon, and as in gunnery, history is very prone to repeat itself, it is quite possible that the double-barrelled rifle may again be resorted to for military purposes.

Specimens of early double guns are extremely rare, and but few are preserved in any of the known museums of Europe.

This is conclusive proof that the double gun (especially that descrip-

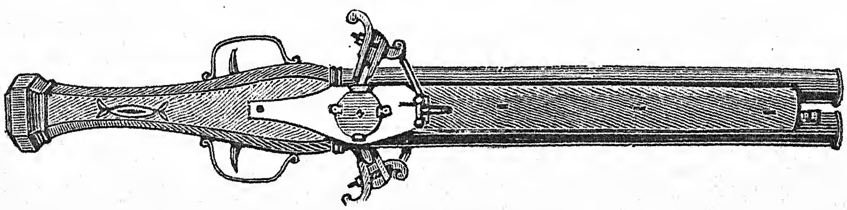


Fig. 75.—Double Horse-pistol of the Sixteenth Century.

tion in which the barrels are side by side) is a comparatively modern invention; and we do not think it could have been in general use until the latter half of the last century, or more specimens would have been preserved.

In most of the early double guns the two barrels were placed one over the other. Fig. 75 represents an early double arm, a long German pistol for horseback use.

The illustration fully explains itself, as the weapon was so formed as to shoot with either barrel uppermost, and was only the crude idea of a double-barrel firearm. Towards the latter half of the sixteenth century, wheel-lock carbines with two barrels, one over the other, were made in Germany. The barrels turned upon a common axis, and were fired by a separate or common lock, as already illustrated.

In the Tower of London there is preserved an early double firearm of the commencement of the seventeenth century. It is a long double pistol, in which the barrels are placed side by side. We illustrate it in Fig. 76. It is an early specimen of the wheel-lock, and the shape of the stock or handle is remarkable.

The weapon appears to have been intended for sporting purposes. It is ornamented with brass, and has barrels about eighteen inches in length. These two weapons are clumsily made, and unwieldy; not so, however, is the pretty little Italian arquebus illustrated in Fig. 77. This handy little weapon appears to have been manufactured for solely sporting purposes, and is the earliest double sporting gun with the barrels side by side that we have ever seen. It is a wheel-lock arquebus of about the

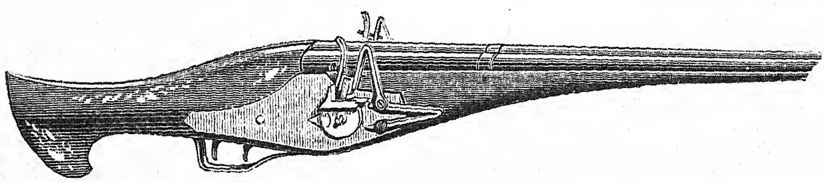


Fig. 76.—Double Pistol of the Seventeenth Century.

middle of the seventeenth century. It is beautifully ornamented with chiselled copper mountings: the barrels are nicely finished, both at the breech and muzzles, and the flash-pans are also of copper. The barrels are about twenty-two inches long and half-inch bore, but the name of the maker is wanting.

A similar gun, but of a considerably later date, is preserved in the Paris Museum, and bears the name of Berch.

With the introduction of the wheel-lock, the gun came into more general use as a sporting weapon. Guns were made considerably lighter, and a steady aim might be acquired. A manufactory for sporting arms was in existence at St. Etienne, France, during the early part of the sixteenth century; and in 1583 a poem by Claude Gauchat, a Frenchman, and entitled "Les Plaisirs des Champs," describes several kinds of shooting with arquebus fowling-pieces. He recounts the exploits of himself and his friends, but does not mention shooting on the wing. He gives, however, one instance of killing an animal in motion, where he "pierced

through with two impetuous leads" a wild boar running. This seems to indicate the use of a double weapon, though it may have been that the one barrel was loaded with two bullets, not at all an uncustomary method of loading amongst early German sportsmen. An Italian sporting work entitled "Excellenza della Caccia, dicclare, solatio, Romano, anno 1669," informs us that the art of shooting on the wing was first practised in Italy about 1580.

Four-barrel guns, with as many locks, and with the two upper barrels a few inches longer than the lower ones, were manufactured at St. Etienne during the seventeenth century; but until the introduction of the double sporting fowling-piece, about the middle of the eighteenth century, double guns appear to have been of very rare occurrence. There is a notion very prevalent that the improvements of sporting guns followed those made in firearms for military purposes; but that this is erroneous a slight investigation will show; and further, that in reality it is the other way about: for in olden times, as at the present, the most ingenious and skilled artificers devoted their energies to the production of perfect weapons for the chase.

The great step to the success of the double fowling-piece was the employment of twist barrels, which enabled two barrels to be manufactured as light or even lighter than it had previously been possible to make a single barrel of equal length and strength. Who first made use of twist barrels we are unable to say: no reliable clue is to be found in any of the leading sporting or technical works yet written: but it appears to us that the principle is of Eastern origin. Probably the most expensive and renowned gun-barrels of the Turks, as

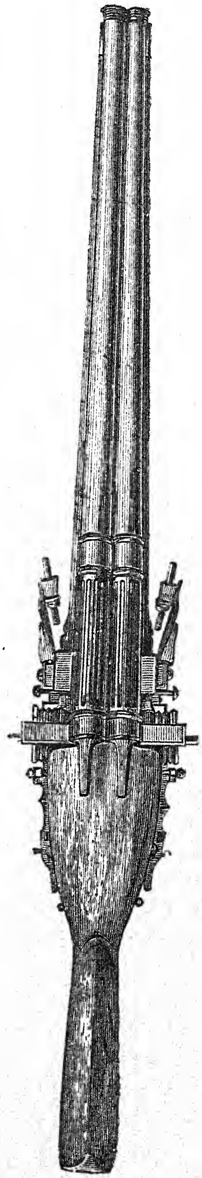


Fig. 77.—Italian Arquebus.

well as their other weapons, were made from the world-famed Damascus iron. This gave a beautiful appearance and tenacity to the barrel, and several Turkish arms of this description are to be found in the Paris Museum. In the same collection there can also be seen several Turkish wall-pieces of the early part of the eighteenth century which have twist barrels, in some cases made from one riband, the majority from two, and a very few from three ribands. The exact date of these arms, however, has not been arrived at, some being taken at the capture of Algeria, and others preserved as souvenirs of the Crimean War. In England twist barrels do not appear to have been made in any numbers until towards the close of the eighteenth century, when the English gunmakers made strenuous efforts to gain supremacy over the Continental manufacturers. Instead of devoting their skill to the embellishment of the exterior, as did their foreign compeers, the English makers sought to reduce the weight, improve the shooting powers, and perfect the lock mechanism of the sporting guns. The twist barrel was the means of effecting the first, the knowledge of mechanics and the vast improvement in machinery gradually developed the second, and the ingenuity, skill, and continued application of the gunmaker brought about the third; so that at the commencement of the nineteenth century the English gunmakers were acknowledged ahead of the Continental makers, who for nearly 500 years had taken the lead in all matters relating to firearms. The English makers had also paid attention to the shaping and fitting of the stock, so that a quick and certain aim might be taken. Thus, in 1800, the English fowling-piece was a well-balanced, light, and effective weapon, and from that time the tide turned, and England has since held the sway, all Continental nations copying the English models, and vainly striving to regain their lost supremacy. Of late the fashion in guns has been entirely in the hands of the best English gunmakers, who, disclaiming elaborate devices, have gained their reputation through the soundness and durability of their work. The flint-lock reached its zenith about 1815, when the renowned Joseph Manton—the king of gunmakers—had so improved and added to its mechanism as to make a first-rate sporting gun veritably an engine—for it is from that word that the term "gun" is derived. The various improvements to effect self-priming and to render the flash-pan watertight greatly added to the mechanical parts, and a pair of the best pattern flint-

locks, well made and finished, were well worth the £7 paid for their manufacture. Manton's latest improvement in flint-locks was the gravitating stop, which rendered it impossible for the cock to fall upon the hammer whilst loading the gun. The use of them was, however, superseded by detonating guns, to which Manton also devoted a portion of his time. This wonderful maker appears to have led the fashion in everything relating to firearms, and his pattern locks, stocks, and furniture were minutely copied by gunmakers of less note. Illustrated in Fig. 78 is the Manton fowling-piece, showing his well-known pattern hammers and cocks,

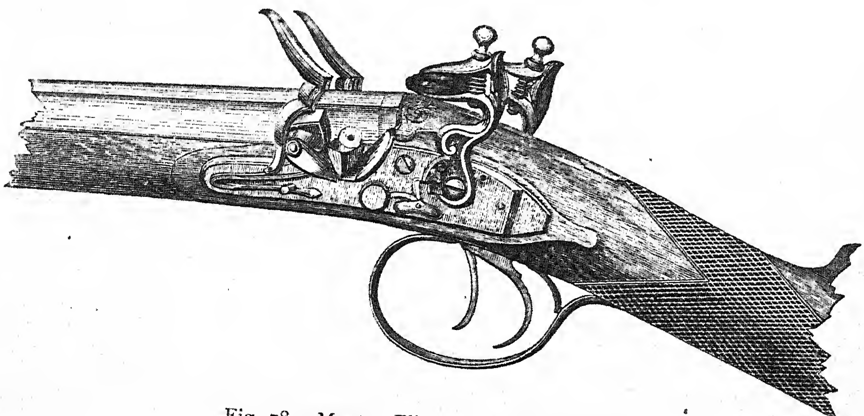


Fig. 78.—Manton Flint-lock Fowling-piece.

the watertight flash-pan, and his gravitating stops. Joseph Manton, although he received the extraordinarily high price of seventy guineas for his best guns, failed several times, and died poor. This is accounted for partly by the losses he sustained in law-suits respecting his patents. He was buried in Kensington Cemetery, and a monument bearing an epitaph composed by Colonel Hawker gives the date of his death—29th June, 1835, aged 69—and eulogises his work as a practical gunmaker and inventor. About this time, also, other gunmakers did great things to heighten the reputation of the London trade. Amongst these the names of Nock, Wilkinson, Egg and Smith are the more famous. Egg also died poor, and, as Colonel Hawker puts it, "instead of cutting up fat, as was expected,

E

he died like a man of genius, with his balance on the shady side of the book."

The business of Manton was carried on, until a few years ago, under the name of John Manton; and Egg's successor has also closed. In 1844 Colonel Hawker gave a list of the London gun trade, enumerating 101 makers and dealers. Now, in 1883, there are 101 makers in London, of whom sixty-five may be considered *bonâ fide* dealers or makers, the remainder being implement-makers, stock-dealers, pop-gun makers for fairs, saloons, &c.

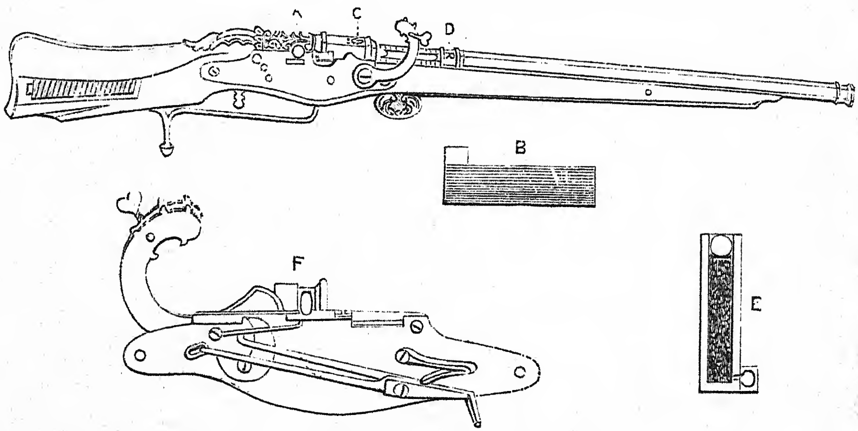


Fig. 79.—Breech-loading Arquebus of King Henry VIII.

EARLY BREECH-LOADERS.

One of the earliest breech-loading hand-guns is to be found in the Tower of London, in the specimen cherished as the hunting arquebus of Henry VIII. Fig. 79 represents this curious weapon. It is a match-lock arquebus, and bears the letters H. R. and the date 1537. The system of loading is similar to the Snider breech-action. The breech-block is, however, hinged on the left side, and opens from the right to left. The charge is put in a small steel thimble or chamber, which has a false flash-pan and touch-hole in one side that fits into the flash-pan upon being placed in the chamber. The shape and comparative size of the movable chamber is shown in the engraving at B, and

in section at E. A is the breech-block, C the Royal arms, D the King's initials, and F shows the mechanism of the lock. It will be seen that a rod actuating a lever to the flash-pan cover is affixed to the scear, so that upon the scear being raised the cover slides from over the flash-pan. This weapon is probably of French manufacture. The armourer's mark is a *fleur-de-lys* surmounted by the letters W. H. It has also stamped on the breech a crowned rose supported by two lions. The barrel is fluted, and about 3 ft. 6 in. in length.

Another breech-loading arquebus was in common use in Germany during the earlier half of the sixteenth century. In this gun, represented with its movable chamber in Fig. 80, the barrel is chambered

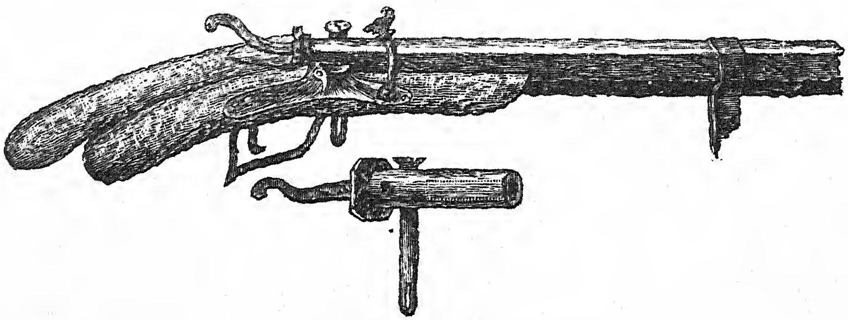


Fig. 80.—Early German Breech-loader.

to take a steel thimble and breech-block in one; the thimble having an elongated tail or handle to enable of its being easily moved in or out of the chamber. The thimble is retained in the barrel during the discharge by a cotter pin passing through the barrel, the base of the thimble, and the stock, firmly wedging the whole together, and similar to the German breech-loading cannon shown in Fig. 15.

Henry IV. of France is said to have invented a similar breech-loader, with which some of the French troops were armed during his reign.

The next breech-loading arm appears to have been of French invention and made about the middle of the seventeenth century, called the Amusette du Maréchal de Saxe. It was usually made as a wall-piece, but a few were also manufactured as carbines for use by the dragoons. By turning the

trigger-guard the breech-plug was caused to open, the block consisting of a cylindrical plug. The charge was placed in loose, cartridges not being invented till several years afterwards. It was soon discarded, on account of the great danger in manipulating the weapon, for the friction was so

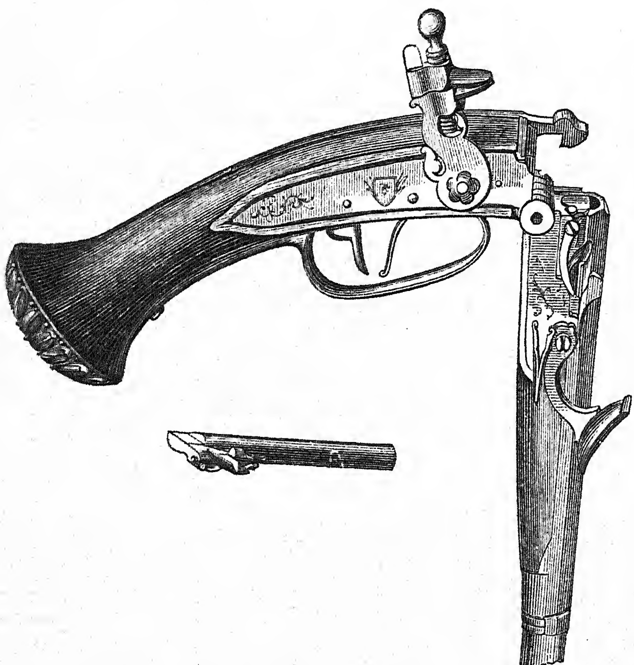


Fig. 81.—Early Breech-loading Flint-lock Pistol.

great that the gun frequently went off before the breech-plug was returned to its place.

During the seventeenth and eighteenth centuries breech-loading arms were very numerous and of greatly diversified mechanisms; it will therefore only be in the compass of this work to describe and illustrate a few of them. Wheel-lock arquebuses on the drop-down system were manufactured in the second half of the sixteenth century, but in most of these early arms breech-plugs and fixed barrels were employed. In

many instances the charge is placed in the breech-block, and not in the barrel itself.

For sporting weapons breech-loaders of curious forms have been made, and generally on the drop-down system. It is not, however, until after the introduction of the flint-lock that any valuable inventions

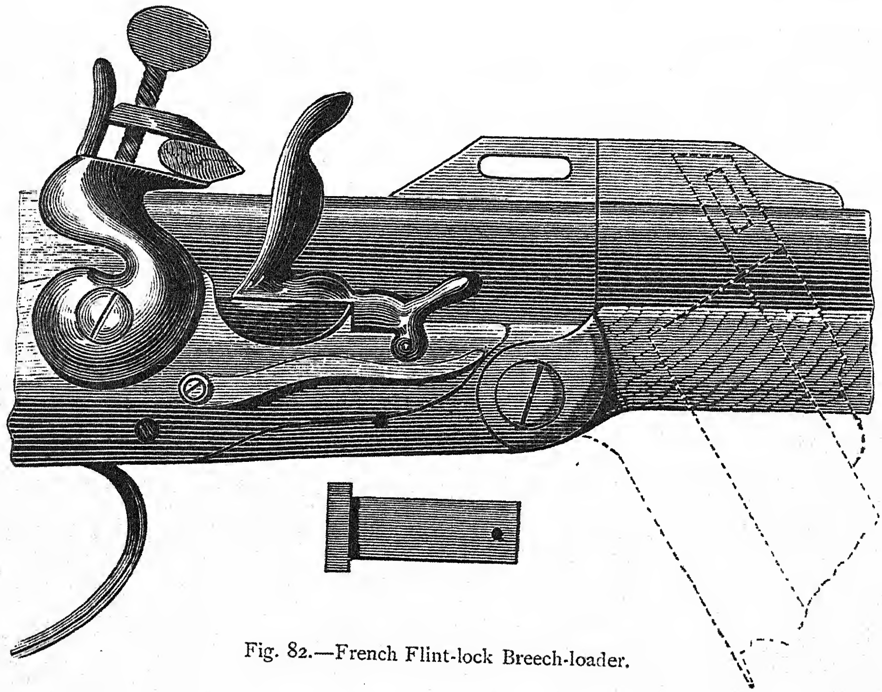


Fig. 82.—French Flint-lock Breech-loader.

are recorded. Amongst these early arms the one shown in Fig. 8 is worthy of comment.

It is a very long-barrelled pistol, probably of Italian manufacture about the middle of the sixteenth century. The barrel drops on a hinged joint, to allow of the insertion of the charge in a movable steel chamber. It is retained in its position for firing by a catch on the top of the false breech, and actuated by a spring trigger in front of the lock trigger. The similarity that this weapon bears to the breech-action

of that recently introduced by J. H. Walsh, Esq., has been noted by some of the readers of the *Field*, who commented upon the hinged joint and the barrel falling at right angles to the stock, which peculiarities were supposed to have belonged to Mr. Walsh's gun only. A gun similar to this one is preserved in the Edinburgh Museum, except that the barrel is retained in position by a sliding bolt, and not by a spring catch.

Guns, however, in which the barrels drop at right angles to the stock are not rare. We have met with several amongst the continental museums, and illustrate one in Fig. 82, which possesses also an ex-

Fig. 83.—Italian Flint-lock Breech-loader.

tended top rib and top cross-bolt, moved by the hand. This gun—which appears to have been considerably used—is still sound and in working order. Both the fastenings—the hook and the hinge—being placed behind the joint, it has kept the breech close and firm. No cartridge was used in this gun, but the charge was inserted in the rigid breech-end of the barrel, and not in the movable fore-part. The top cross-bolt is shown detached half-size, and the position of the barrel when open is indicated by the dotted lines.

Fig. 83 illustrates an Italian flint-lock gun, the mechanism of which is the best made of any we have noticed amongst the arms of the seventeenth century. It is by the celebrated Aqua Fresca à Borgia, and bears the date of 1694.

By pressing the guard a catch under the barrel is released, and the barrel being pivoted vertically, a lateral motion may be given to the barrel, which swings open horizontally, as shown in the illustration. The charge, contained in a steel tube, may then be introduced, and the barrel returned to its position. By a system of wheels the gun primes itself, the powder being placed in the magazine affixed to the hammer. The butt is hollowed to contain bullet-mould, and the whole weapon is nicely finished, the mountings being of chiselled steel.

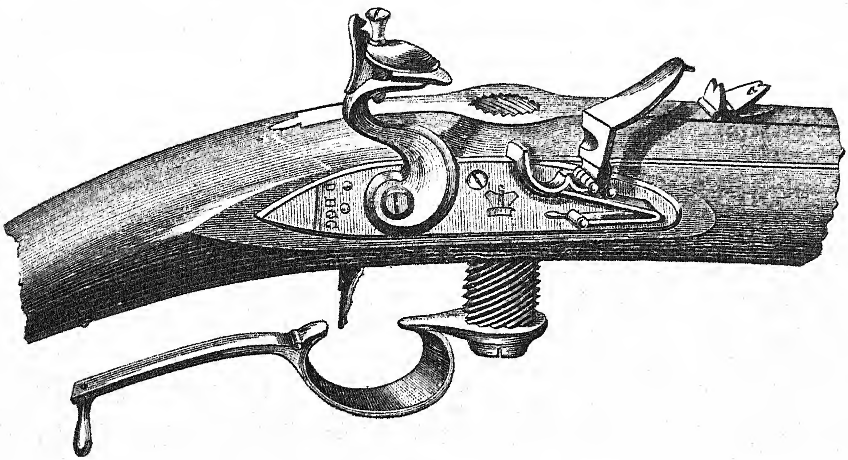


Fig. 84.—Fergusson Breech-loading Rifle.

During the eighteenth century breech-loading flint guns were made in which the barrel or barrels revolved on a common axis, as shown in Fig. 51, a space being cut from the side of the arm to allow of the insertion of the cartridges. In single-barrelled weapons the barrel was usually pivoted on a centre considerably below the axis of the barrel, so that upon the barrels being turned it was thrown clear of the stock. The barrel was kept in position for firing by means of a spring stud or catch entering into the barrel from the false breech.

A breech-loading carbine, known as the Fergusson rifle, was used in the American War of Independence, and is illustrated in Fig. 84.

It is the first breech-loading carbine ever used by a regularly organised

British corps, and is the invention of Patrick Fergusson, Major, 2nd Batt., 71st Regt. Highlanders, who constructed it some time previous to 1776. It is a flint-lock, and sighted from 100 to 500 yards. The breech mechanism consists of a three- to twelve-thread vertical screw plug, passing through the breech-end of the barrel. This screw plug is attached to the trigger-guard, which, when turned, sinks the screw plug, leaving an aperture in the top of the barrel for the insertion of the cartridge or charge. The screw is then raised by replacing the guard, and the aperture leading to the barrel chamber thereby closed.

The next breech-loading arm is that of Mr. Theiss, of Nuremburg. In

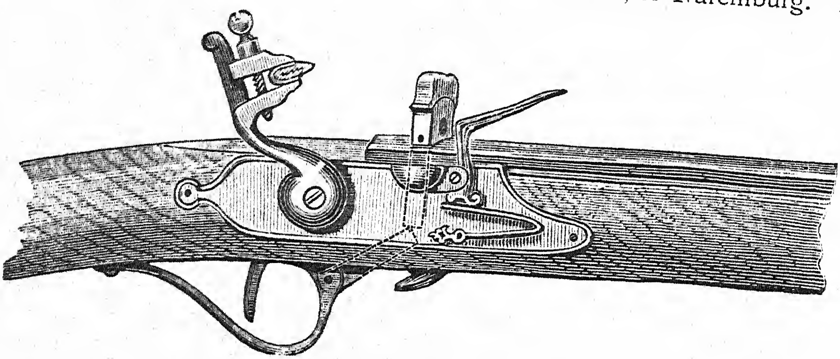


Fig. 85.—The Theiss Breech-loading Gun.

this arm (Fig. 85) the stock is hollowed immediately behind the breech of the barrel to admit of the charge being introduced, the barrel being closed by a vertically-sliding breech-block, actuated by a button attached to a lever under the barrel in front of the guard. When pushed upwards by the button, a hole in the breech-block is in a line with the axis of the barrel. Through this aperture the cartridge is pushed into the chamber of the barrel, which is closed by knocking down the breech-block. The weapon is a flint-lock, and was manufactured in Germany about 1804, but was discontinued owing to the large escape of gas at the breech.

Another flint-lock breech-loading arm is illustrated in Fig. 86, the invention of an American, who afterwards made arms on the interchangeable system for the United States Government. In this arm the breech-block itself is loaded, the flash-pan, hammer, and cock all being arranged

in or upon the movable block. After loading, the block is depressed and kept in position for firing by a spring catch working under the barrel; the block is similar to that of the Martini, but moves upwards instead of downwards.

This action may be considered a sample of that generally employed in old wall-pieces, though the modifications are so numerous that only a cursory notice of them would fill a volume. A few remarks upon these wall-pieces will, however, not be out of place. As muzzle-loaders, wall-pieces on account of the length of their barrels, were most difficult to load, so that we find more breech-loading wall-pieces than early breech-loading small-

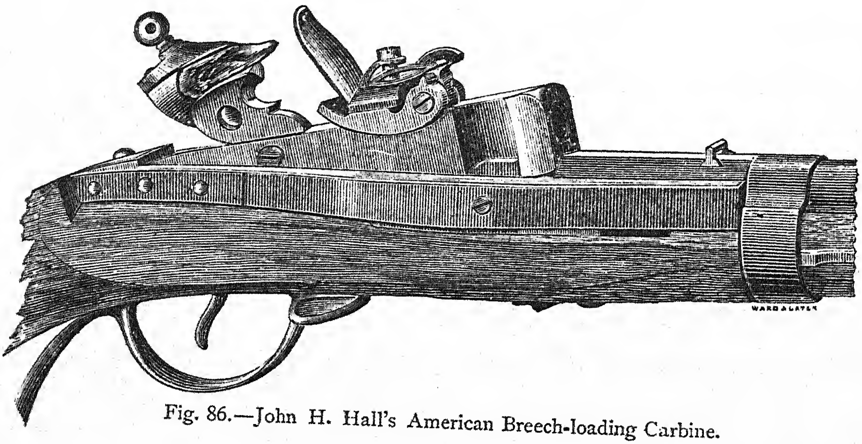


Fig. 86.—John H. Hall's American Breech-loading Carbine.

arms. In some cases cartridges were used, which were placed in the barrel itself or in the breech-block. Rigid barrels and movable blocks appear to have been the principle on which they were constructed. We have never seen or heard of a wall-piece with hinged barrel. The breech-blocks were, however, of various shapes, some being vertical and others horizontal, lying at right angles to the barrel. The flint-lock was the one generally employed, and the weight may have ranged from 25 to 150 lbs. each arm, the barrels in some instances being of great length, the longest we have seen being that preserved in the Paris Museum, in which the barrel is nearly 11 feet long; and there are

several over 9 feet. In the Dresden and Munich Museums there are also some heavy wall-pieces. The arms taken by the French from the Algerians also include some very rare wall-pieces of Turkish origin and manufacture. The barrels are of Damascus twist, and are nearly all sighted for two or more ranges; one has a back-peep sight, pierced with twelve apertures, so that elevation may be obtained for almost any range. In these Turkish Chinese, and Tartar *fusils de rempart* we find the match-lock used for firing the charge. Wheel-locks have also been affixed to some of the early wall-pieces, but they are very rare compared with the flint and match-locks, we having only met with about twenty, whilst several hundreds of flint-lock pieces have come under our notice.

The wall-pieces were made bell-nosed to shoot slugs, but when firing single bullets they were usually poly-grooved; they continued in use until the middle of the present century, the last being made for France on the percussion principle in 1842.

With this short notice must be dismissed the "Ancient Arms," and the development of the fire-arm traced through the percussion era.

During the period extending from the year 1300 to the commencement of the present century—a term of 500 years—fire-arms had been used in Europe employing in their discharge but one explosive—gunpowder. The charge had been ignited at base, centre, and front; the rival systems of breech and muzzle-loading being fought out time after time; and a muzzle-loader with charge ignited at the *base* accepted as the most capable weapon, when the application of fulminates—and ignition by detonation—to fire-arms, caused this perfected flint-gun to be quickly laid aside, and its use amongst civilised people is now almost obsolete.

THE PERCUSSION SYSTEM.

THE first researches for fulminating or detonating powders appear to have been made by Peter Bolduc, a Frenchman, at a date anterior to 1700. In the reports of the Royal Academy of Sciences from 1712 to 1714, notices are given of the experiments of Nicholas Lemery in the same direction. Nothing of great importance appears to have been arrived at by either of these personages, but in 1774 Bayen, chief army physician to Louis XV., discovered *fulminate of mercury*, and made known its explosive properties; but there was no idea, even at that time, of applying fulminates in any way whatever to firearms; and it was not until after the discoveries of Fourcroy in 1785, of Vauquelin in 1787, and of Berthollet in 1788, that an attempt was made to provide a substitute for saltpetre in gunpowder by the use of chlorate of potash.

Berthollet, the famous chemist and experimentalist, essayed in vain to effect this; and, after two successive explosions—cruel evidences of the terrible force of the new salts—he desisted, although not entirely relinquishing his researches, as he studied the fulminates, and discovered *fulminate of silver.*

Immediately the explosive became known, endeavours were made to use it in pyrotechnical displays, and after a few trials it was applied to firearms, but did not answer effectually; its extreme sensitiveness, and the great care required in handling and using it, rendered it most unsuitable for pyrotechnical purposes.

Scientific persons then endeavoured to combine with the fulminate of silver other combustible ingredients that would render it less sensitive, such as a mixture of chlorate of silver and sulphur, iodate of potass, with sulphur, ammoniates of gold, platinum, silver, &c.

In 1800 an Englishman named Howard, after a study of the experiments of Vauquelin and Fourcroy, essayed to manufacture a fulminate composed of fulminate of mercury and saltpetre. This powder was extremely sensitive, possessed all the requisite qualities of a priming powder, and was for years known as Howard's powder. Fulminate of mercury is formed by the combination of oxacid of cyanogine ($Cy^2\ O^2$), or fulminating

acid, with protoxyde of mercury, the chemical formula being (Hg. O.) $^2Cy^2\ O_2$; thus analogous to fulminate of silver, which is formed by the combination of fulminating acid with protoxyde of silver, as shown by the formula (Ag. O) $^2Cy^2\ O^2$. To prepare fulminating mercury, 1 part of mercury is dissolved in 12 parts of azotic acid at a temperature of 38° to 40° by the Baumé areometer.

To this mixture is introduced, little by little, 11 parts of alcohol about 85° or 88° in strength; the whole is then warmed in a double bath until it gives off white and thick vapours. Upon cooling, small crystals are formed of a yellowish white colour, which, after being washed in cold water, is fulminating mercury.

Fulminating silver is produced in a similar manner. The azotic acid is mixed whilst warm; *and white* powder is deposited upon cooling—fulminating silver. These early accounts of fulminating powders are of French origin, and we are indebted for the details to Louis Figuier, in "Les Merveilles de Science." The English history is somewhat different, according to the Patent Office Records. The Rev. Alexander John Forsyth, LL.D., a Scotch clergyman, and for fifty-two years minister of Belhelvie, Aberdeenshire, is the person to whom the honour of inventing the percussion system is awarded; his letters patent, dated April 11th, 1807, describe the *application* of the detonating principle for exploding gunpowder in firearms, &c. Various modes of applying the same to ordnance are shown. The validity of this patent was disputed in the case of "Forsyth *v.* Reveiere," tried in the King's Bench, June 4th, 1819, in which it transpired that other persons had privately used a similar invention before the date of the patent—which, however, was established; the judge (Abbot, L.C.J.) ruling that if several persons simultaneously discover the same thing, the party first communicating it to the public is the legal inventor, and entitled to the protection of letters patent. When Lord Moira was Master-General of Ordnance (1806) Mr. Forsyth, at his request, carried out some experiments in the Tower of London, with a view to the application of the detonating system to existing arms, but the experiments did not culminate in the immediate adoption of the invention, and, after a few months, Mr. Forsyth returned to Belhelvie and resumed his pastoral duties, not further engaging with gunnery. His inactivity with respect to his clever invention led to his patent being evaded by many persons. The fulminating

mixtures he made use of are thus described in the specification of his patent:—

"I do make use of some one of the compounds of combustible matter, such as sulphur or sulphur and charcoal, with an oxymuriatic salt; for example, the salt formed of dephlogisticated marine acid and potash (oxymuriate of potassium), or of fulminating metallic compounds, as fulminate of mercury or of common gunpowder, mixed in due quantity with any of the afore-mentioned substances, or with an oxymuriatic salt as aforesaid."

With regard to the manner of ignition, the specification reads:—

"Instead of permitting the touch-hole, or vent, of the species of artillery, firearms, mines, &c., to communicate with the open air, and instead of giving fire by a lighted match, or flint or steel, or by any other matter in a state of actual combustion, applied to a priming in an open pan, I do so close the touch-hole or vent by means of a plug or sliding-piece so as to exclude the open air, and to prevent any sensible escape of the blast, or explosive gas or vapour, outwards, or from the priming or charge; and, as much as it is possible, to force the said priming to go in the direction of the charge, and to set fire to the same, and not to be wasted in the open air."

The charge was fired by a plunger working in a hole having communication with the charge, at the bottom of which a small quantity of the detonating mixture had been previously placed. The rod was struck by a cock, or, in artillery, by means of a hammer. This invention cannot be too highly appreciated, for by the application of it an entirely new system of ignition took place. The hammer was at once dispensed with, and the cock struck upon fulminating powder placed in the flash-pan. The powder a short time afterwards was placed between two thin pieces of paper, and were called percussion pellets. One is illustrated in Fig. 88. Shortly afterwards they were manufactured as a riband, and made self-priming.

Numerous inventions between 1807 and 1825 relate to self-priming guns, and the systems are greatly varied; sometimes the fulminate was enveloped in paper or metallic covers, and in others the powder was simply rolled into small pills or pellets.

In 1821 Westley Richards invented a percussion gun which ignited with either the simple detonating powder, the paper caps, the pellets or the balls. This gun, which enjoyed a wide popularity in the shooting world, is illustrated in Fig. 87.

The cock strikes into the flash-pan, which is covered with a pivoted lid actuated by a spring.

The falling of the hammer causes the cover to move from over the pan,

by its breast pressing against an extremity of a pivoted lever, whose other extremity is connected with and actuates the pan-cover.

The touch or communication hole is situated in the bottom of the pan, and enters the barrel in an oblique direction. A small peg is screwed through the cock-nose so that the point of the peg falls into the centre of the pan, which is concave, and thus renders the percussion more certain.

In France similar improvements were being made. In 1808 a Genevan gunmaker named Pauly, practising in Paris, invented a percussion breech-loading gun, in which a fulminating paper cap was affixed to the breech of

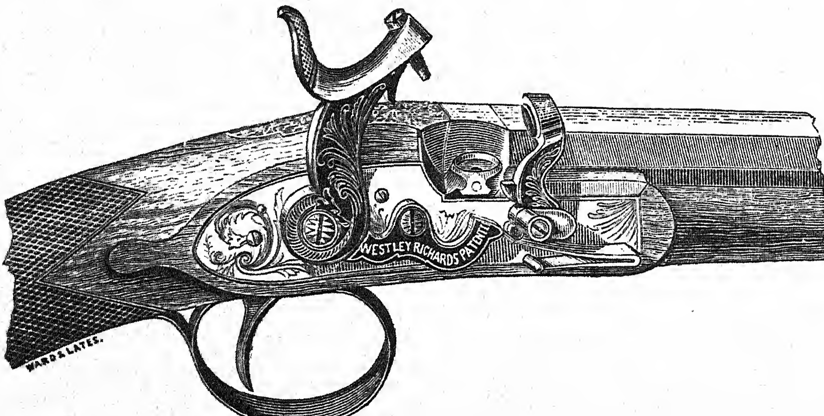


Fig. 87.—The Westley-Richards Detonating Gun.

the cartridge. Upon pulling a trigger, a needle pierced the cap, and thus ignited the charge. As this model was far from perfect, it was abandoned; but thirty years later we find a slight modification of the same gun again introduced, under the name of the Prussian needle-gun.

In 1812 this same Pauly invented a percussion gun, in which the hammer, cock, and flash-pan were dispensed with, all being replaced by a small piston, actuated by a spiral spring, striking a nipple upon which a few grains of fulminate were placed.

In 1818 the copper cap was made in England, and introduced into France one year later by M. Degoubert. In England the inventors of the copper cap were as numerous as the gunmakers—nearly every armourer, London and provincial, laying claim to the invention.

Colonel Hawker says respecting it:—

"The copper cap is now in general use all over the world, and therefore many gun-makers attempt to claim its invention as their own. I do not mean to say that I was the inventor of it—probably not; but this I must beg leave to state:—When Joe (Manton) first brought out his detonator in Davies Street, he made me the most perfect gun I ever saw; and doubting whether such another could be got, I set my wits to work in order to simplify the invention. At last the plan of a perforated nipple, and the detonating powder in the crown of a small cap, occurred to me. I made a drawing of it, and took it to Joe. After having explained it, he said he would show me something in a few weeks' time, when, lo and behold! there was a rough gun altered to precisely my own plan—his factotum, poor old Asell, informing me that the whole job was done from my drawing. Thus Joe, who led the fashion for all the world, sent out a few copper-cap guns, and I

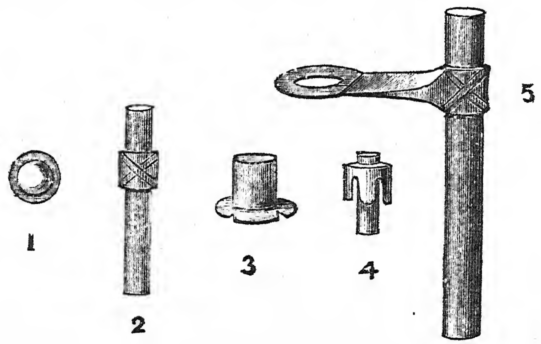


Fig. 88.—Detonators.

know with some degree of reluctance. The trade, finding he had then deviated from his own patent, adopted this plan, and it proved to answer so well that we now see it in general circulation."

The reason for Manton's reluctance appears to be that he wished to push his own patent tube-gun, in which a metal primer was used, being placed in the touch-hole and held in position by a spring, and exploded by the blow of the cock.

Many similar systems were used and patented between 1812 and 1825. The chief systems were those of Egg, Wilkinson, Lancaster, Lang and Westley Richards. The accompanying illustration shows a few of the numerous detonators; many others existed but a very short time, and were not extensively used.

No. 1 represents the paper cap, the fulminate being placed between two small pieces of paper. No. 2 is a priming-tube, the one end being inserted

in the touch-hole and the other struck by the cock. No. 3 is a musket percussion-cap. No. 4 is the Westley Richards' primer. This consisted of a priming-tube with flanges affixed to it. The tube was inserted in the nipple, the flanges preventing it being driven in altogether when struck by the cock. No. 5 is a friction tube, as used for firing cannon. These tubes are placed in the touch-holes of the cannon. A string, attached by a hook to a ring fixed in the tube, enables the horizontal arm to be sharply drawn across the tube, and the friction so caused fires the fulminate contained in the tube. These tubes are made of brass or other metal for field use, but of quills for use in the navy. Percussion-caps are filled with mixtures slightly different to those described for detonating tubes, &c. The government caps for muzzle-loaders were filled with a mixture composed of chlorate of potass six parts, fulminate of mercury four parts, powdered glass two parts. In breech-loading caps, the mixture is slightly different. In sporting caps, chlorate of potass and sulphur are sometimes used without fulminate of mercury or silver. Equal parts of these two substances are carefully prepared and mixed: caps so made are, however, uncertain in their ignition, and highly corrosive.

In ordinary caps, a mixture of sulphur with either chlorate or nitrate of potass and fulminate of mercury is used, the powder, when well mixed, being pressed carefully into the cap, and secured there by a metal disc and a spot of varnish. The mode of obtaining the fulminates differs slightly. Fulminate of silver may be made by dissolving 50 grains of silver in about ¾ oz. nitric acid, of 1.37 specific gravity, and adding at a gentle heat 2 oz. alcohol, continuing the heat until reaction commences, when the nitric acid oxydises a portion of the alcohol to aldehyde and oxalic acid. This acid, again, acts on the alcohol, producing nitrous ether, fulminic acid, and water. The fulminate of silver is deposited upon the mixture, cooling in the shape of small, white, crystalline plates, which should be washed in cold water, and dried in *small quantities* in a warm place. The fulminate of silver is the most dangerous of all chemical compounds. There are two kinds known to chemists—the one already described, and another, a darker, ammoniacal, fulminating compound, which, however, is useless, as it cannot when made be removed from the vessel in which it is contained, so prone it is to explode.

Fulminate of mercury is prepared in a similar manner to fulminate of

silver, but more alcohol is required; a large volume of carbolic acid, nitrous aldehyde, and a thick red vapour in dense fumes is given off, and the crystals may be greatly improved by solution in boiling water, and re-crystallisation.

These compounds will fire either by percussion or friction, and are so rapid in their action that if a train of fulminate be laid across a train of ordinary gunpowder and the latter be fired, the explosion of the fulminate, being so much more rapid, will sever the connection between the two parts of the train of gunpowder, so that the second half of the train will not be ignited. A very small quantity of fulminating mixture is sufficient to load a percussion cap, indeed 1 lb. avoirdupois of mercury will produce sufficient fulminate to charge nearly 20,000 caps. When first made it was a very common error to overload the cap. This caused very serious accidents, the metal being in some caps none of the best; and the extra charge of detonating powder caused them to fly to pieces, with occasionally most disastrous consequences to the shooter or his companion, and many a sportsman has lost an eye through this cause. The metal was also too thin, and some makers tried to substitute other compositions for copper, such as brass. The late Mr. W. Greener used tinned iron caps. Percussion caps are rendered water-tight by placing over the powder a small metal disc, and dropping a spot of varnish upon the same. Neither the disc without the varnish, or the varnish without the disc, will, however, make a cap effectually water-tight, the varnish being water-proof and the disc damp-proof. Caps properly made, with well-fitting discs, may be immerged in brine for fourteen days without rendering the detonating mixture useless.

Percussion guns were not accepted as superior to the flint immediately upon their introduction, for many old sportsmen, and notably Colonel Hawker, adhered to the flint principle. Owing to the various plans tried to obtain magazine primers, the percussion system was not adopted by either the English or the French Governments until about 1840, when the ordinary cap was decided upon, the magazine system being pronounced unsuitable.

The prevalent idea is that a percussion gun will shoot considerably stronger than a flint gun with the same charge.

The ignition given to the charge is certainly more rapid, and there is not the violent escape of gas at the nipple as there is at the touch-hole of a *flint gun.* The penetration and recoil are therefore proportionately increased. Colonel Hawker made several trials between flint and detonating guns, the results showing the advantage of the flint system. He thus addressed Joe Manton after this trial:—

"From the result of very many experiments, Colonel Hawker is of opinion that for neat shooting in the field or covert, and also for killing, single shots at wild-

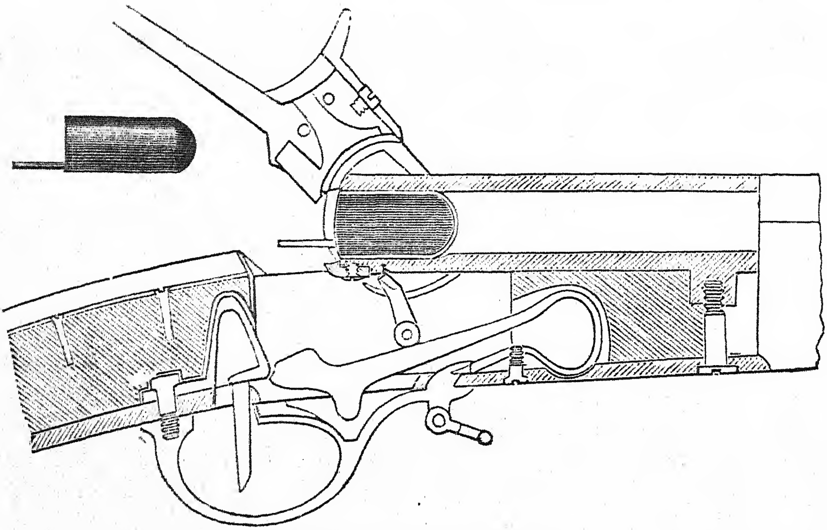


Fig. 89.—Demondion's Breech-loader.

fowl rapidly flying, and particularly by night, there is not a question in favour of the detonating system, as its trifling inferiority to the flint gun is tenfold repaid by the wonderful accuracy it gives in so readily obeying the eye. But in firing a heavy charge among a large flock of birds the flint has the decided advantage.

"Moreover, the sudden and additional recoil of a detonator with the full charge for duck-gun is apt, if the shooter be not careful, to strike the hand back and give him a severe blow on the nose."

Colonel Hawker, however, was certainly biassed, for other contemporary writers contend that the percussion cap was a decided improvement, as it caused the gun to shoot much stronger, the ignition of the charge to be more rapidly effected, and to render miss-fires of rare occurrence.

With the flint lock in a heavy shower of rain, or a continuous drizzle, it was a matter of impossibility to keep the priming-powder dry. With detonating paper caps and pellets the same difficulties were experienced, and it was not until the introduction of the copper cap that the percussion gun could be considered in every way superior to the flint.

To proceed now to the early percussion breech-loaders. Amongst the first was that of a Frenchman named Robert. His gun, however, was so faulty as to fall quickly into oblivion. It consisted merely of a hinged breech-block, pulled from over the breech-end of the barrel by a large hand-lever.

In 1831 M. Demondion patented a breech-loading percussion gun which is illustrated in Fig. 89. In this arm the breech-block was raised for loading by means of a lever attached to it, and lying along the top of the grip when in position ; the act of raising the breech-block depressed the mainspring hammer situated beneath the barrel until it engaged with the spring trigger, in shape similar to a door-catch. The cartridge had a small percussion tube projecting from the base, against which the flattened end of the mainspring struck to discharge the gun, the base of the breech-block acting as an anvil on which to strike the tube.

The lock mechanism will easily be understood by referring to the illustration, and the cartridge case was self-consuming, so that no extractor was needed. This arm is one of the first in which cartridges containing their own ignition were used.

GILBERT SMITH'S AMERICAN RIFLE.

In this arm, Fig. 90, the barrel drops for the insertion of the cartridge, which is of india-rubber, with a perforated cardboard base. The barrel breaks off in the middle of the chamber, and falls at nearly right angles to the stock, as shown by the dotted lines. The cartridge being flexible, it readily accommodates itself to the fixed portion of the chamber, and the base being perforated an ordinary cap is sufficient to ignite the charge. This weapon was brought over to England about 1838, and submitted to the British Government ; but the escape of gas at the joint—which it was thought would be avoided by having the breech in the centre of the cartridge—was sufficient to condemn it. This gun is fastened at the top by means of a horizontally-sliding bar

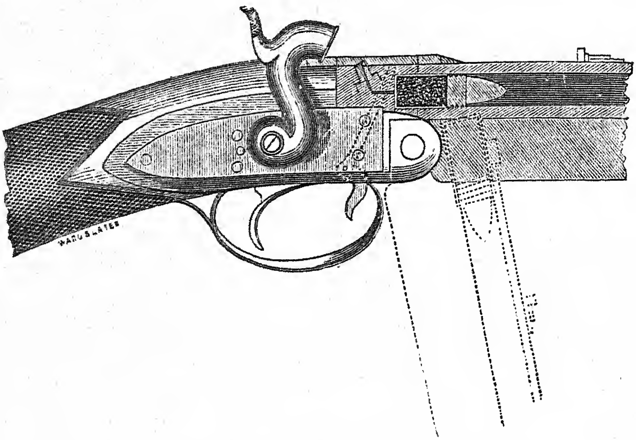


Fig. 90. —Gilbert Smith's American Carbine.

actuated by a small trigger-lever in front of the lock-trigger, the whole action being very similar in mechanism to that of the French flint-lock breech-loader represented in Fig. 82.

THE NORWEGIAN CARBINE.

Illustrated in Fig. 91 is the Norwegian military arm of 1842. The action is different to any we have yet described, the hollow breech-

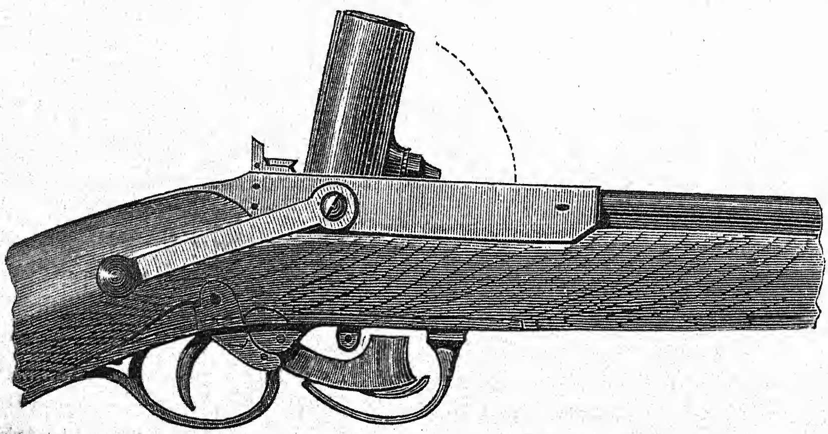


Fig. 91.—Norwegian Carbine, 1842 Model.

block being pivoted upon a strong pin, and worked by a side-lever which works upon an eccentric affixed to it. By depressing the lever the breech-block is withdrawn from the barrel and raised, as shown in the illustration, and the cock situated beneath the barrel must be depressed to full-cock. The charge is placed in the breech-block, and the cap placed on the nipple, which when returned to its proper position for firing is in a vertical position, projecting from underneath the barrel. The main-spring is fixed to the fore-part of the stock, and works along

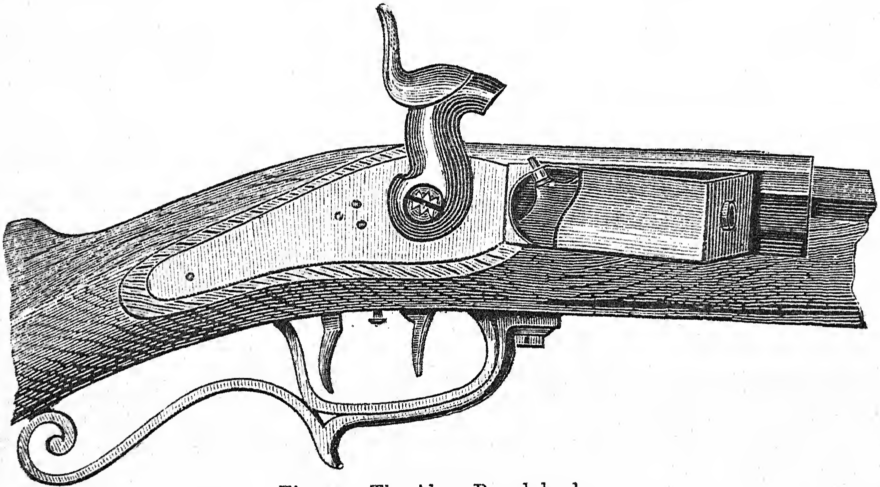


Fig. 92.—The Abezz Breech-loader.

the back of the cock. There is a small stud projecting from the breech-block as a safeguard against the premature ignition of the cap. It must be moved from position by the hand before firing.

The sight is placed on the break-off immediately behind the base of the breech-block. The weapon is about 500 bore, and rifled with six grooves.

In 1851, Karl d'Abezz, of Zurich, invented the percussion breech-loading carbine illustrated in Fig. 92. As will be seen by the illustration this gun is loaded in the breech-block, which is capable of moving horizontally in a frame connecting the barrel with the stock. The movement is communicated to the breech-block by an eccentric pivot

actuated by a quarter-turn of the lever under the guard. A forward motion is given to the block by the eccentric pivot when returning it to its place, so as to insert the projecting neck on the breech-block into the barrel itself.

Thus the greater portion of the strain was sustained by the eccentric pivot attached to the lever. The lever moved to the left to open the gun-block, and an ordinary cap, cartridge, and lock were employed.

WESTLEY RICHARDS' CAPPING BREECH-LOADER.

This was adopted as a cavalry arm in 1861. The principle is the same

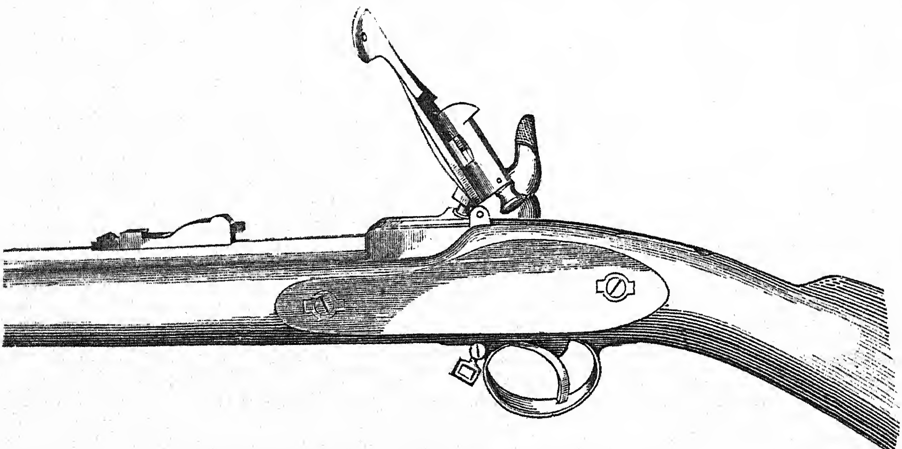


Fig. 93.—The Westley Richards Capping Breech-loader.

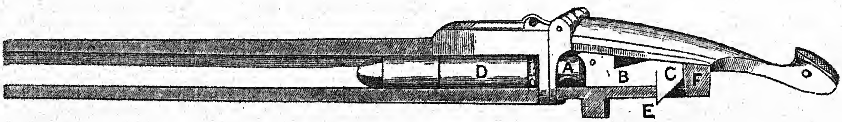


Fig. 94.—Mechanism of the Capping Carbine.

as Green's and Terry's, with some difference in the breech arrangement; instead of the bolt-plunger being drawn back for loading, it is attached looseiy to a hinged flap or lid. By raising this flap to a vertical position the cartridge can be inserted, being pushed home by the thumb. The flap is then shut, and the point of the plunger fills up the opening in the breech;

the rear-end gets a solid bearing at the breech, which enables it to receive the recoil without any danger of flying open. The bore is 52 or 450. It is very accurate, and has a long range. It can be fired six or seven times in one minute with comparative ease, and is the best capping breech-loader that has ever been produced. It has been much in favour as a sporting breech-loader, and is still extensively used in South Africa. By inserting a metal plug and two felt wads in the breech-chamber, this rifle can be used as a muzzle-loader. The cartridge for this rifle is a self-consuming one; composed of a soft paper envelope, with a soft felt wad at the base. The cartridge is ignited by a percussion cap, the flash of which is strong enough to penetrate the said paper envelope, and explode the charge. The wad expands and prevents escape of gas at the breech. The next cartridge inserted takes forward the expanded wad, and it goes out with the charge.

It will be seen from Fig. 94 that the base of the cartridge, D, is in contact with the movable brass breech-plug, A, which is affixed to the sliding block, B, kept in position by the base of the action-shoe, F, against which it presses at C, and thus sustains the whole of the recoil. If all the parts are not well fitted, especially the brass plug, A, the lever is apt to fly up at the moment of discharge, and the gases find an exit at the breech, the block only being kept down by a small lever-spring on the top of the barrel and the bearing of the sliding-block, between E and F. The sliding-block, B, must also work freely, or it will be a difficult matter to depress the lever into its proper position for firing.

The *Mousquetoon des Cent Gardes* was invented in France shortly afterwards. The mechanism of this gun and the cartridge is illustrated in Fig. 95. The cartridge used is similar in construction to the Lefaucheux. The pin A for the cap is placed under the base of the cartridge, and projects barely $\frac{1}{8}$-inch. The long pin, F, on the top of the case is to withdraw it from the chamber after discharge. The stock is hollowed behind the breech to readmit of the cartridge being pushed into the barrel A. The breech-block B carries a small stud *b*, which strikes the cap of the cartridge C when the gun is fired. Affixed to the block B is a scear D, forming part of the trigger-guard, the other part being composed of the scear and trigger-spring F, one end acting upon the trigger E, and the other causing the breech-block, D, to fly upwards with sufficient velocity to close the breech

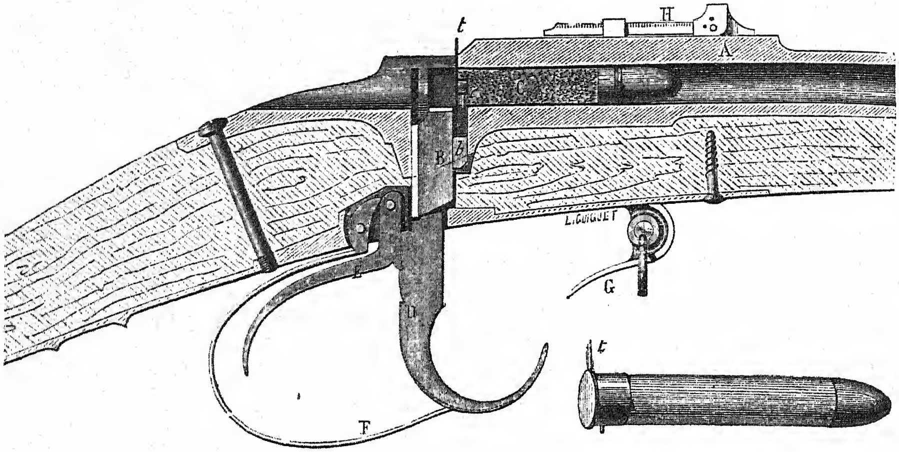
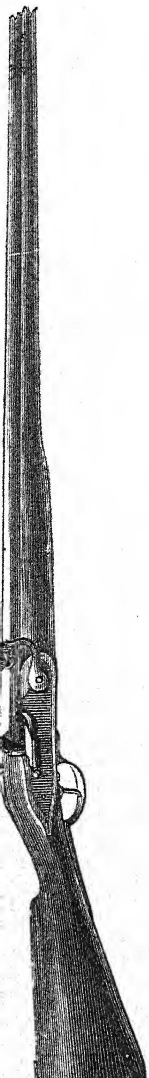


Fig. 95.—Early French Military Breech-loader.

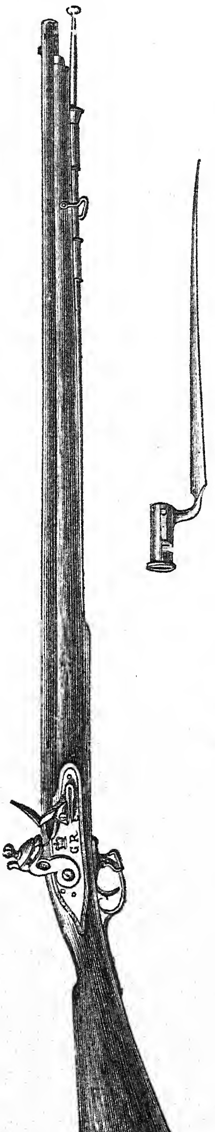
of the barrel and detonate the cartridge cap. G is a swivel and guard, to prevent the finger coming under the scear tail. The manipulation of this arm is said to have been difficult and dangerous.

THE GUNS OF THE BRITISH ARMY.

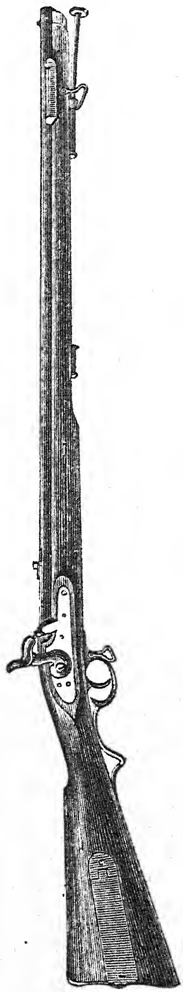
As herein previously stated, fire-arms were introduced into the English army in 1471. They were used at the siege of Berwick in 1521, after which a body of arquebusiers formed a portion of the British army, although they were not considered a very valuable adjunct. The weapons used from 1471 to the Commonwealth, with a few modifications, were similar to the adjoined illustration, Fig. 96. During the reign of James I. a few of the leading regiments were armed with flint-lock guns. In the reign of William III. the flint-lock came into use, and from it was developed the renowned "Brown Bess," which for a century and a half was the regulation arm of the British forces. It was slightly modified for hand and sea service, but the difference was trifling. Fig. 97 illustrates this weapon. It weighed 11 lbs. 2 oz. The barrel was 3 feet 6 inches long, and the bore ·753 in., or 11 guage. The bullet used was about three sizes smaller than the bore, and was wrapped up in a loosely-fitting patch which



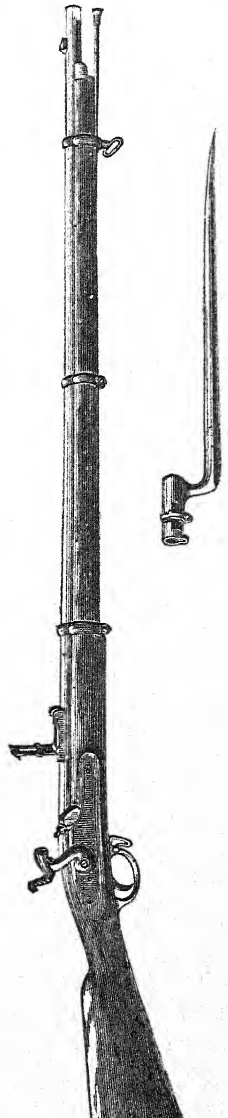
96.—Matchlock Musket.



97.—Brown Bess and Bayonet.



98.—Brunswick Rifle.



99.—Enfield Rifle and Bayonet.

formed a cartridge. The service charge was $4\frac{1}{2}$ drams, and a bullet of 490 grains. Little was expected of the Brown Bess, and she did that little well. She was easy to load, even when foul, and beyond her rude lock there was no mechanism to get out of order; and as a contemporary author remarked, "in any case she was a good handle for a bayonet." Compared with ancient rifles, the Brown Bess could hold her own as a military weapon.

The old muzzle-loading rifle employed in connection with a tightly-fitting spherical ball never was, and never could be, employed by troops generally, the force required to push home the bullet rendering its use as a weapon of war impossible. Many thousands of the Brown Bess pattern, or regulation muskets, were converted to percussion muskets after the introduction of that system, and many new guns were made of the same pattern, but with percussion locks, between 1840 and 1850. These guns were more evenly bored than the earlier patterns, and, as smooth-bore guns, performed remarkably well. The following table gives the result of a trial between the percussion musket of 1842 pattern and the Minié rifle. Twenty men fired each ten rounds, five in file and five volley firing, against a target 6 feet high and 20 feet broad.

RESULTS.

Distances.	Percussion Musket.		Minié Rifle.	
Yards.	No. of Hits.	Per Cent.	No. of Hits.	Per Cent.
100	149	74·5	189	94·5
260	85	42·5	160	80·0
300	32	16·	110	55·
400	9	4·5	105	52·5

It was remarked that whereas the shots that missed the target from the common musket fell from twenty to fifty feet wide of the target, those from the Minié fell within two or three feet.

Amongst the curious arms already mentioned there has been noticed Fergusson's breech-loading rifle, which was used in the British army during the latter half of the eighteenth century, but never adopted as a standard arm.

After the French wars, the chief military powers of Europe found the plan of loading a rifle to be so intolerable, that the English, French, and Prussian authorities each determined, almost at the same time, to set themselves the problem of discovering an efficient substitute. The Brunswick rifle, Fig. 98, was produced. In this arm the grooves were reduced to two, a belted ball was used. The length of the barrel was 2 feet 9 inches; the bore ·704 in., or 13 guage, and the weight 11 lbs. 5 oz. The labour of loading was greatly diminished, but the shape of the projectile was ill-adapted for piercing the atmosphere. When the bullet left the muzzle the belted side went foremost; but quickly obeying the ordinary mechanical laws, it revolved on its shorter axis, presenting its larger area or flat side to the air. To equalise this in some measure, the four-grooved rifle was introduced, with two belts round the bullets, at right angles to each other; but neither of these arms were sufficiently successful to be adopted as standard military weapons, although in those made notches were cut through the barrel at the muzzle to show the position of the grooves, in order that a soldier might lose no time in inserting the bullet, even at night.

Shortly after the introduction of the Brunswick rifle, the Minié rifle was produced, and his principle adopted by the British Government, who gave M. Minié £20,000 for his invention. The Minié principle of the expanding bullet was, however, invented by the late W. Greener, and offered to the British Government some twelve years before the Minié rifle was invented, but was not accepted by them, being pronounced by a select committee as *useless and chimerical.* Mr. Greener, after the adoption of the Minié principle, made a claim to the Government for some recognition of his invention. After considerable trouble and expense, and adducing undeniable proof, he was awarded £1,000. In 1841 he published a work on Gunnery, in which the expanding bullet was described. This work was translated into French, and the general belief is that Minié derived his information from that source.

The Greener expanding bullet (Fig. 100) consists of an oval ball with a flat side, and having a perforation that extends nearly through it, and a cast metallic taper plug, with a head like a round-topped button. The end of the plug being slightly inserted in the perforation, the ball is put into the rifle either end foremost, and upon the explosion taking place, the

plug is driven home, and the bullet expands, filling up the grooves, and preventing windage.

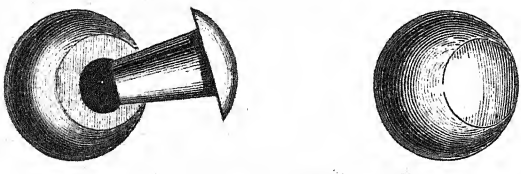


Fig. 100.—Greener's Expanding Bullet.

In the Delvigne carbine, the invention of a French captain, the bullet was expanded by the blow of the ramrod when loading. The system is shown in Fig. 101, which represents the bullet in position ready for firing.

It will be seen that the powder is contained in a chamber smaller in diameter than the barrel, and the bullet, upon being dropped down the barrel, is arrested by the conical shoulder of the powder chamber; it is then flattened out with the ramrod until it fills the grooves of the barrel.

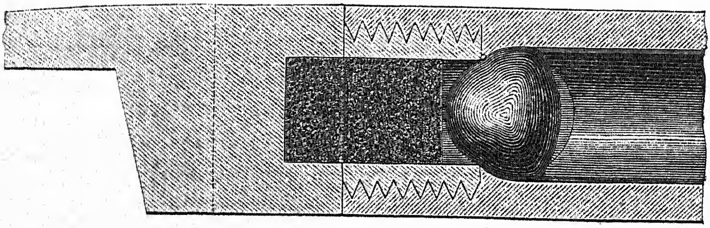


Fig. 101.—The Delvigne Bullet.

This arm was offered to the French Government, but rejected, as the advantage in shooting was slight, and the trouble of loading very considerable. M. Delvigne then conceived the idea of constructing a bullet with a hollow base, which, by the explosion of the powder, was expanded until it partly filled the grooves.

In another French carbine, a cylindro-conical bullet was expanded at the base by ramming it home against a hardened steel plug projecting from the centre of the breech-plug through the powder chamber. About 1848 Minié introduced his expanding bullet, illustrated in Fig. 102. In the base of an elongated bullet a taper recess is formed, in the mouth of

which is placed an iron cup, which, immediately upon the discharge, is driven up, and the bullet thus expanded.

Sometimes, however, the explosion caused the iron cup to flatten, in which case the bullet was divided into two parts at the bottom of the recess, the fore-part of the bullet and the flattened cup issuing from the muzzle, and the hollow base remaining tightly wedged in the breech of the barrel. Upon being re-loaded, the charge of powder would slip through the hollow base and the bullet rest above it, when the same thing would again occur—the base remaining each time until the accident was discovered, and we ourselves have seen as many as eight hollow bases extracted from a single barrel.

The late W. Greener tried ineffectually to improve the bullet by a flanged plug.

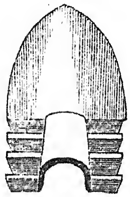


Fig. 102.—The Minié Bullet.

A modification of the Minié principle was, after much consideration, adopted by the British Government as the standard arm, to which the name of the Enfield Rifle was given. The bullet only differed in the cup, which was dispensed with, and a solid clay or hard wood plug used in its stead. The regulation Enfield rifle, Fig 89, was 3 feet 3 inches long in the barrel, with three progressive grooves, that is to say, 10-1,000ths deep at the breech, and 5-1,000ths at the muzzle, the spiral of which was one turn in 6 feet 6 inches, and the bore 577; weight, 8 lbs. 8 ozs. There were three screw bands, and a bayonet nearly 18 inches long in the blade. The arm was sighted to 1,000 yards, and fired a 530 grain expanding bullet, with a charge of $2\frac{1}{2}$ drs. This rifle was known as the 1853 model.

All the Enfield rifles were considered accurate at 600 yards range.

The Enfield rifle was a combination of several systems sent to the Government by various gunmakers, who thought of having their rifles adopted *in toto*. The Government, however, made use of the various good

points in each, and constructed the new model rifle at their own works at Enfield, from whence it derives its name.

The short Enfield rifle was 2 feet 9 inches long in the barrel, with five progressive grooves; spiral one turn in 4 feet 6 inches; weight of arm, 8 lbs. 7 ozs., with iron furniture and mountings. A sword-bayonet was used with this arm 6 inches longer in the blade than the triangular regulation pattern. Similar arms were made for the sea service, but brass-mounted.

The Enfield cartridge was of greased paper, and reversed in loading; that is to say, it was untwisted, the powder poured in, the case reversed, the bullet inserted, and the paper case torn off, &c.

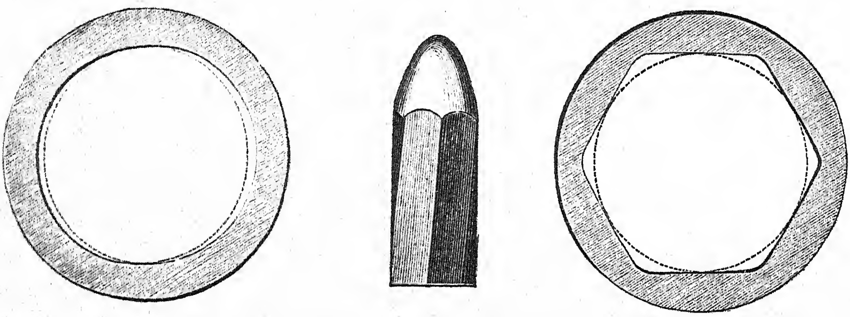


Fig. 103.—Whitworth Rifling and Bullet, and Lancaster Oval Rifling.

The British Government also supplied Sir Joseph Whitworth with the means of experimenting with his rifle, and to excel, if possible, the Enfield system. Much money was spent in these trials. A 500 yards' range, entirely covered in to protect it from wind or weather, was constructed at a considerable cost, and the rifles submitted to exhaustive trials.

Mr. Whitworth produced his hexagonal rifle with a bore of ·450 inch or 52 guage. The extreme length of the projectile and the quickness of the spiral was considered a great marvel at the time.

The bullet and sectional cut of the Whitworth barrel is shown in Fig. 103.

The bullet weighs 530 grains, and is 1⅝ inch in length; it is also hexagonal. The barrel is formed like a female screw, completing one turn in 20 inches, or two turns in the barrel of 3 feet 4 inches; it is hexagonal, with its largest

diameter, that is, from angle to angle, ·500 inch; the diameter from side to side, ·450 inch.

The highest scientific and mechanical means were made use of to produce this system. The barrel was carefully bored, the best steel used, and the grooves polished as fine as a mirror. The bullet, ·5 inch diameter, 1·375 inch length, with cupped base, instead of being cast, was accurately produced by machinery, and composed of an alloy of lead, tin, and manganese, to render it of sufficient stability to resist the "squashing" or swaging to which all long projectiles of soft metal have a tendency.

The objections raised to the rifle were numerous, but the experiments and the production of the system will always be regarded as of great scientific value. In actual practice, this rifle was not so successful, the extreme accuracy required in the forming of the barrel and the mechanically-fitting bullet rendering it a delicate and expensive weapon. It is, however, very accurate, and performed well at considerably over 700 yards, and for many years carried off all the prizes at the public matches and trials.

Mr. Whitworth's experiments proved the greater accuracy the ·450 bullet possessed over those of larger diameters; breech-loading cannon are still made upon the mechanically-fitting projectile principle, but for small arms the system is unsuitable, and the introduction of the Snider breech-loader prevented the adoption of the Whitworth in military circles.

Lancaster's oval bore consists of a two-groved rifling, the two grooves being so expanded and shallow as to make an elliptic bore. The idea of an elliptic rifle is an old one, and was simply revived by the late Mr. Lancaster. This system was fully tried, most expensive machinery with epicycloidal cutters fitted, was laid down so as to produce a perfect bore; yet both in cannon and small arms, with every amount of spiral plain and accelerating, the system proved a complete failure. For further information on this rifling, see "Sporting Rifles."

SNIDER'S SYSTEM.

The Government having a large stock of Enfield rifles in hand, conceived the idea of converting them to breech-loaders, and offered a prize

for the best system. The plan adopted was the now well-known Snider system, but of which a short description will not be out of place.

About two inches of the upper part of the breech-end of the Enfield barrel is cut away at the top, for the admission of the cartridge and bullet, which are pushed forward by the thumb into a taper chamber, formed by slightly enlarging the breech-end of the barrel. The vacant space behind the cartridge is now closed by a solid iron breech-block, which fills up this hollow and gives the rifle the appearance of a muzzle-loader. This breech-block is hinged upon the right side of the barrel, and is opened sideways by the thumb of the right hand. The block forms a false breech, and receives the recoil from the base of the cartridge. A piston or striker passes through this breech-block, the point being flush with the face of the breech, and immediately opposite the cap of the cartridge, until a blow from the hammer upon its other end, which projects above the breech, and is kept in position by a sloping nipple, drives it forward and strikes the cap, denting but not penetrating it, but with sufficient force to explode the cartridge. The empty cartridge-case is withdrawn by a claw extractor attached to the breech-block, which, when open, is drawn back with it about half an inch. The cartridge-case is brought entirely out of the barrel, and by turning the rifle sideways the empty case falls to the ground. There is a spiral spring fitted upon the hinge-rod, which takes the block and the extractor back into position. The delay caused by the withdrawal of the empty case is very slight. Some objections have been made to the spiral spring in this rifle, but it is not absolutely necessary to the system, as the first arms were made without springs; but such as have springs are much quicker and more convenient to handle. The exploding-pin is also worked by a spiral spring.

In some of the first conversions a portion of the barrel was removed to admit of the breech-block; but it is now found more convenient to make the whole of the breech arrangement separate, and to screw it upon the back end of the barrel, which is shortened and screwed for the purpose. One of the advantages of this principle of conversion is, that the stock is not cut away or weakened by the introduction of the breech-action. This is considered an important point, as the soldier requires a stout pike as well as an efficient fire-arm. Several of the other competing systems were rejected in consequence of the cutting away and weakening of the stocks.

The Snider proved to be the quickest and strongest breech-action submitted, and was least liable to injury from the effects of the explosion. The first arms had no arrangement to fasten down the block, except a small spring stud at the back of the breech-block, which merely kept it steady, and prevented it flying open when being handled. When a proper cartridge was used there was no tendency to cause the block to fly up, as

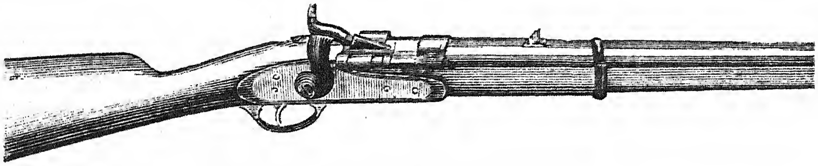


Fig. 104.—The Snider Cavalry Carbine.

the force is all exerted backwards; but it was afterwards found that some of the breech-blocks blew up, in consequence of a number of imperfect cartridges having been supplied. These cartridges permitted an escape of gas through the rim, this rushed under the breech-block and forced it open; the defect was remedied for the time by the issue of more perfect cartridges. A later improvement is the spring bolt, which effectually secures the block, and prevents it from rising even when a bad cartridge is inserted.

The accompanying illustrations of the "Snider" will convey a good idea of this truly reliable weapon.

The bore is ·577, or 25 gun-gauge. This form of breech arrangement is

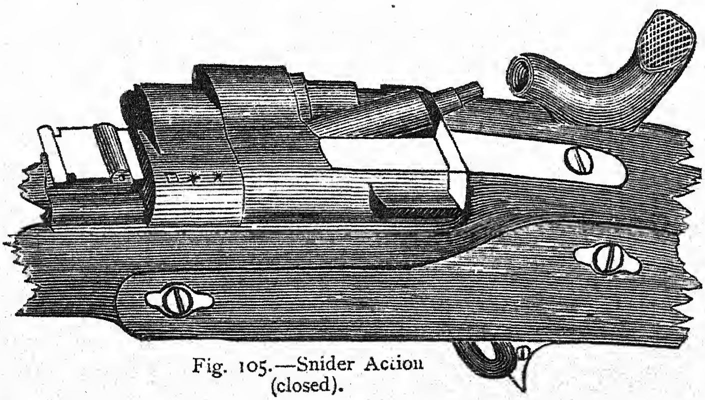


Fig. 105.—Snider Action (closed).

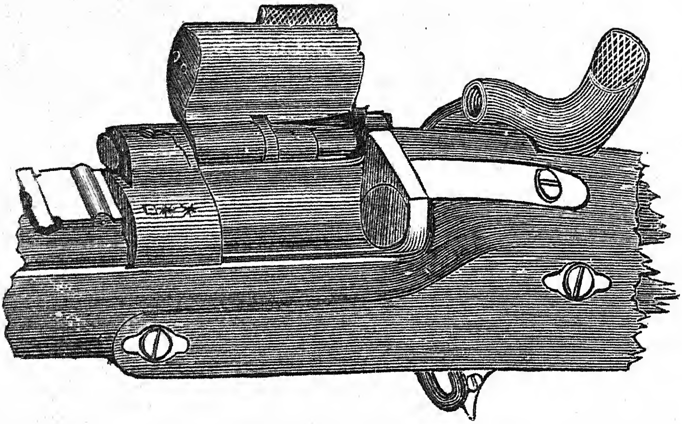


Fig. 106.—Snider Action (open).

not original. Many specimens, similar in construction, may be seen in our museums of ancient arms. The success of this breech-loading system is entirely owing to the adoption of the metallic form of cartridge. None but a perfectly gas-tight cartridge would answer with this action. The first Snider rifles submitted to competition took a pasteboard cartridge with a metallic base on the central-fire or "Pottet" principle, similar to

SECTION OF "BOXER" CARTRIDGE, ·577 BORE.

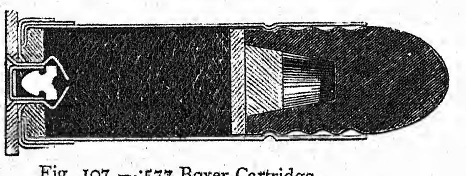


Fig. 107.—·577 Boxer Cartridge.

those now used in sporting breech-loaders. Although this cartridge was not exactly suited to this particular weapon, it proved to the Select Committee that a cartridge containing its own ignition, and being at the same time thoroughly gas-tight, was preferable to all other systems. Having decided to adopt the Snider, they turned their attention to the cartridge, and referred the matter to Colonel Boxer, of the Royal Laboratory, who took the subject in hand, and, after great labour and many experiments,

succeeded in producing a cartridge so well adapted for this rifle that it made it a decided success.

Col. Boxer's patent cartridge is an improvement upon the Pottet; the base and mode of ignition are precisely the same, but for the pasteboard tube he substitutes one of brass, formed by coiling sheet metal in double folds and covering it with waterproof paper. It will be seen, by examining the annexed illustration, that there is a papier-mâché wad which forms the base and contains a metallic dome, which receives the cap and anvil. The first Boxer cartridges made had brass rims, resembling the cartridge used in sporting guns. The improved plan is to form the rim by attaching an iron disc to the base of the cartridge, and by riveting it to this dome. This plan ensures the rims being made all of one uniform thickness, which is as essential in a military rifle as in a sporting gun.

The French have also converted a great number of their old muzzle-loading rifles on a modification of the Snider plan, which they call the Tabatière rifle. It takes the Boxer cartridge, No. 12 gauge, with a short conical bullet, which is hollow from the base to nearly the point, and filled up with a plug of papier-mâché. This is done to lighten the bullet and cause it to expand so as to fill up the grooves of the rifling. The breech-action differs slightly from the Snider principle, being cut away at the back of the shoe, to admit of the cartridge being inserted readily. The block takes its bearing on the two sides of the barrel or shoe. The main defect in this plan is, that if a bad cartridge should cause the block to blow open, the head of the soldier would be in danger. This could not happen in the Snider, as there is a solid standing breech behind the opening for the cartridge, which receives the force of the explosion and answers as a shield.

The Russian Government have also converted a large number of rifles on a very similar principle, without remedying its faults.

The Snider has been discarded for use amongst the Regulars, and relegated to Volunteer Corps. Its defects were more apparent in rifling and bore than in the breech-mechanism, which is singularly adapted for military purposes from its strength and extreme simplicity.

THE MARTINI-HENRY RIFLE.

This arm was some years ago offered to and adopted by the English Government as the national arm; it has been slightly improved since its

first introduction, in the mechanism of the lock; the pull of the trigger was originally very unequal; it is now made to pull off more uniformly. This arm, when first issued, had a safety-bolt, which secured the trigger, but they have now been entirely dispensed with as unnecessary.

The rifle is made to take the Boxer regulation cartridge, ·450 bore, which contains a heavy charge. The recoil is, however, rather severe. It is accurate in its shooting up to about 800 yards, but its actual range is considerably beyond this distance; the length of the barrel is 33 inches, a long

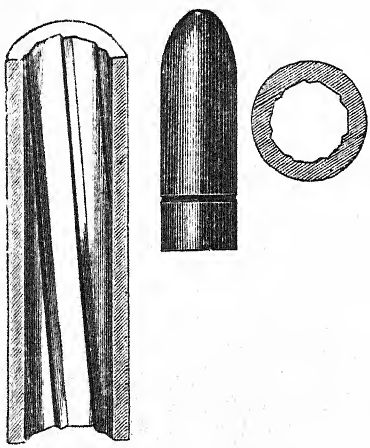


Fig. 108.—The Henry Rifling and Bullet.

triangular bayonet is used, which brings the arm to the regulation length to resist cavalry. The barrel is rifled on Henry's principle, having a spiral of one turn in 22 inches. The grooves are shallow, with the angles rounded. There is also a representation of the bullet suitable for this rifling, which is of hardened lead and weighs 480 grains. The bullet is coated with paper, and expands in the bore, the base being driven in by the force of the explosion of the large charge of powder, thus filling up the grooves of the rifling entirely, and preventing windage. For lubrication, a wax wad is used over the powder. This is a modification of the Whitworth system, and is found to answer well.

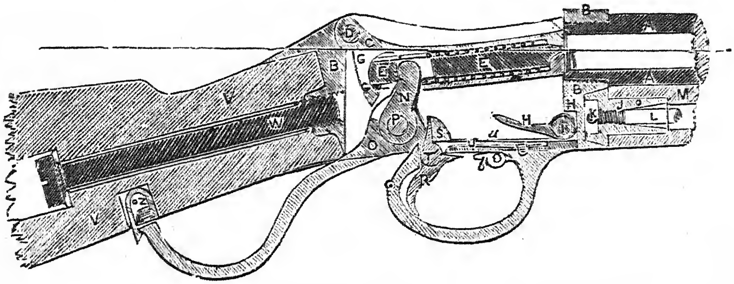


Fig. 109.—The Martini-Henry Breech-loader and its Parts.

AA Barrel.
BB Body.
CC Block.
D Block axis-pin.
E Striker.
F Main-spring.
G Stop-nut.
H Extractor.
I Extractor axis-pin.
J Rod and fore-end holder.
K Rod and fore-end holder screw.
L Ramrod.
M Stock, fore-end.
N Tumbler.
O Lever.
P Lever and tumbler axis-pin.
Q Trigger-plate and guard.
R Trigger.
S Tumbler-rest.
T Trigger and rest axis-pin.
U Trigger and rest-spring.
V Stock-butt.
W Stock-bolt washer.
Z Lever catch-bolt spring and pin.
a Locking-bolt.
b Thumb-piece.

The weight of the Regulation Martini-Henry is 8 lbs. 10 ozs.; bayonet, 18 ozs.; pull-off, 6 lbs. It uses a coiled brass cartridge, containing 85 grs., and a long "picket" of 480 grs. The cartridge case is bottle-necked, being ·577 in. at base, reduced suddenly to ·450 in. This enables the large charge of powder to be placed in so short a ·450 case as 2⅜ inch; but the sudden shoulder increases considerably both the strain upon the barrel and the recoil.

A Table of the speed and accuracy of the various military rifles will be found in the next chapter.

BAYONETS.

The means of converting a military firearm into a pike, and so enable it to be used as either an offensive or defensive weapon, in case of its mechanism becoming disordered or through lack of ammunition, originated first in France. Some peasants of the Basque provinces, whilst on an expedition against a band of bandits, having used all their ammunition, were driven to the desperate necessity of inserting their long knives in the

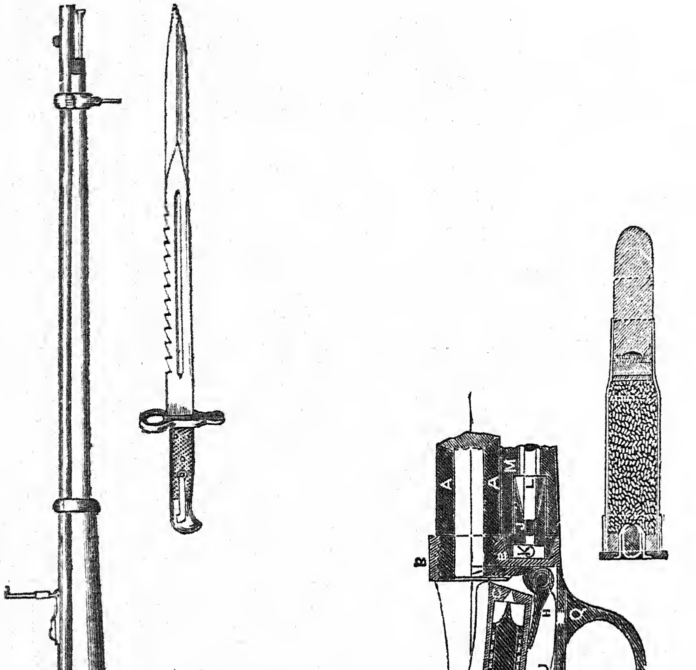


Fig. 11c.—The Regulation Martini-Henry Breech-loader and Cartridge.

mouths of their arquebuses, by which means they routed their adversaries. This event became well known, and led to the construction, in 1641, of the bayonette at Bayonne, a village in the south of France, from which place it took its name. In 1649 the pike was replaced by a long narrow blade fixed to a short wooden handle, which was inserted in the muzzle of the musket, but the advantage gained was inconsiderable, owing to the arm for the time being rendered useless; the wooden handle also not giving sufficient solidity to the blade was shortly afterwards dispensed with, and the iron itself made to screw into the muzzle of the gun.

In 1691 the socket bayonet was invented, some say by an Englishman, others by the French; but during the reign of William III. an English regiment was surprised by a charging French troop, who halted during the charge and fired a volley, causing considerable consternation. Vauban, the famous general of Louis XIV., caused all the French foot-soldiers to be supplied with socket bayonets, and the pike became an obsolete weapon in France.

The bayonet-blades were at first flat rods of iron pointed, sometimes with a long, at other times with a short neck. The Regulation bayonet of the Brown Bess was triangular, with the top side flat, the other two fluted. The Enfield bayonet has all three sides fluted. The bayonet-socket has been improved at various times. In the Enfield bayonet the socket was so shaped as to admit of it being passed over the block foresight, and secured by a half turn of a bayonet-ring. In the Brown Bess bayonet a stop slipped over a spring in the stock, which retained it in position. The sword-bayonet was introduced by the French in 1844 in the rifle of the Chasseurs de Vincennes, and has since been adopted by most European powers for the sappers, engineers, &c., but the triangular bayonet is retained for the ordinary rank and file, although many new combinations have been devised.

The sword-bayonet is naturally so heavy that when used in an engagement, or even at practice, it strains the barrel severely, in many instances completely bending the barrel and rendering the rifle entirely useless as a weapon of precision. Since the introduction of breech-loaders little use has been found for the bayonet, as it now seldom happens that the troops come hand to hand.

The additional weight of a sword-bayonet to the muzzle of a rifle so alters its balance as to make accurate shooting with bayonet fixed next to

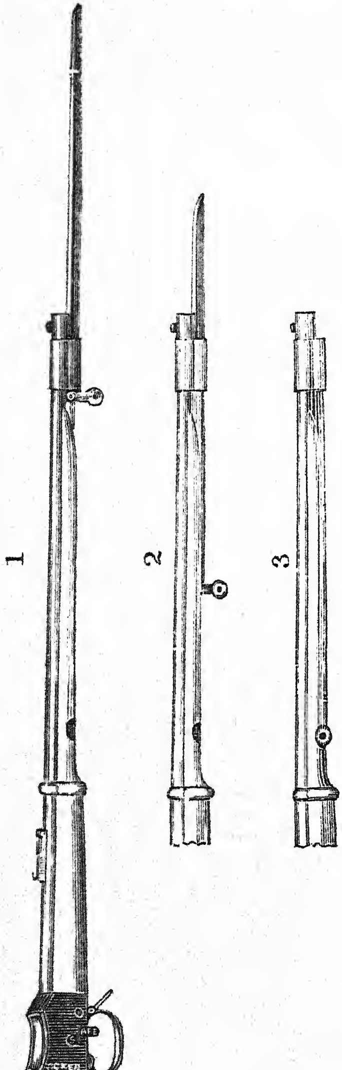


Fig. 111.—Greener's Pencil-case Bayonet.

impossible. In some measure to obviate this, we have invented the Pencil-case Bayonet.

In the fore-end of the stock, which is of little use to a breech-loader, we make a groove, in which slides a triangular bayonet. It is actuated by a knob which lies in the fore-end when the bayonet is home. To thrust forward the bayonet the knob is first moved into a perpendicular position, this releases the bayonet, and allows it to be pushed out by means of the knob and the left hand. The bayonet is kept in a position by turning the knob partly round into a notch in the wide nose-band, and is retained there by a self-acting spring-catch. No. 1 shows bayonet in position; No. 2, bayonet half home; and No. 3, bayonet home.

The strength is equalised, and the bayonet lies closer to the barrel. It is much easier to manipulate, and the absence of the scabbard and frog gives the soldier greater freedom in his movements, and would allow him to carry more ammunition or a light spade—which will be necessary in modern warfare; and its advantages when skirmishing, in the rifle-pits or guerilla warfare, cannot be over-estimated.

Lieut. E. Zalinski, of the United States Army, has designed a very similar bayonet, but he makes it do duty too as ramrod.' Other plans of fixing trowel-shaped bayonets and trowel attachments to the stock to be used as intrenching tools are discountenanced in military circles.

PERFORMANCE OF MILITARY RIFLES.

In modern military rifles the desiderata are accuracy, speed, and simplicity. The first depends wholly upon the rifling and the charge, but in the two latter points numerous systems claim superiority. Many trials of the various rival arms have taken place at different times by order of the War Department, and the following notes may be taken ds the average performance of the arms.

The Snider, with the Enfield barrel, Regulation line pattern, is capable of projecting a Minié bullet of 530 grains about 1,300 yards, with a charge of 75 grains of powder. The trajectory is very high, being over 11 feet at 500 yards. It is not accurate beyond 800 yards, and the bullet falls 12 inches at 100 yards if no elevation is given to the rifle, and $51\frac{3}{4}$ inches at 200 yards.

Of the other large-bore military rifles, the Prussian Needle Gun is possessed of only a moderate degree of accuracy and a high trajectory. Its range is a little over 600 yards. It is 16-bore, and fired with 70 grains of powder.

The French Chassepot is said to have a range of 1,800 yards, with its bullet of 380 grains and 85 grains of powder. It is very inaccurate over 100 yards, being inferior in this particular to the Prussian Needle Gun.

The Martini-Henry, or Government rifle, has a much lower trajectory, and is far more accurate than any of the foregoing. Its range may be estimated at slightly over 1,500 yards, and its accuracy up to 800 yards reliable. At 500 yards the mean deviation of 20 shots has frequently been less than 0.95 feet, and at 1,200 yards 1.05 feet. The trajectory is low compared with other military rifles, for when sighted for and aimed at 500 yards the bullet, at the highest point in its flight, is seldom 8 feet 2 inches higher than the line of aim. For speed the breech-loading rifles yet to be described are considerably before the Martini or Snider. The following table will give some idea of the average relative speed of the various breech-actions without in any case taking aim :—

	Per Minute.
The Soper	58
The Winchester repeating rifle...	52
The Hotchkiss repeating rifle	50
The *Field* rifle	40

	Per Minute.
The Martini	40
The Swinburn	40
The Westley Richards'	38
The Henry	38
The Remington	30
The Mauser	28
The Chassepot	19
The Snider	18
The Braendlin-Albini	18
The Russian Berdan	18
The Prussian Needle Gun	9

More recent magazine arms are said to average 60 to 70 shots per minute, but the statement lacks proof.

The speed obtained by the Soper or the *Field* breech-loading systems are sufficient for any purpose. The Soper has been publicly loaded and fired sixty times in the minute, but the barrel became so hot that the sight, which was soldered on, fell off. A greater speed than forty shots per minute from one barrel is seldom required or desirable, the British soldier carrying but sixty rounds; but, as in the late Zulu war, a greater speed for a few moments may occasionally be of service. For strength, durability, and ease of manipulation, we believe the *Field* rifle stands pre-eminent.

The Soper is open to only one objection: it is not always easy to insert the cartridge, owing to the position of the breech-block. The lever, however, is very handy, and its mechanism far before the Martini. Owing to its complexity, the repeating arm is not altogether *comme il faut* for a military arm. In the Winchester, Spencer and Vetterly, filling the magazine is a tedious process, and the breech-mechanism of the Hotchkiss is too clumsy for easy manipulation.

Some magazine arms possess the advantage of ease in loading without removing the gun from the shoulder, no mean consideration when the soldier is hurried; and it is possible that a good magazine arm will enable a fair marksman to shoot better, as well as faster, when pressed; but most would be worthless in the hands of an unintelligent, excitable recruit.

BREECH-LOADING RIFLES.

THE BRAENDLIN-ALBINI BREECH-LOADING RIFLE,

Adopted by the Belgian Government.

In appearance this rifle is like the Mont-Storm. The block is solid, and is turned over on the top of the barrel for loading. The cartridge is then inserted; the block is then replaced, being held in position by a spring stud until the hammer falls. The hammer carries with it a locking-

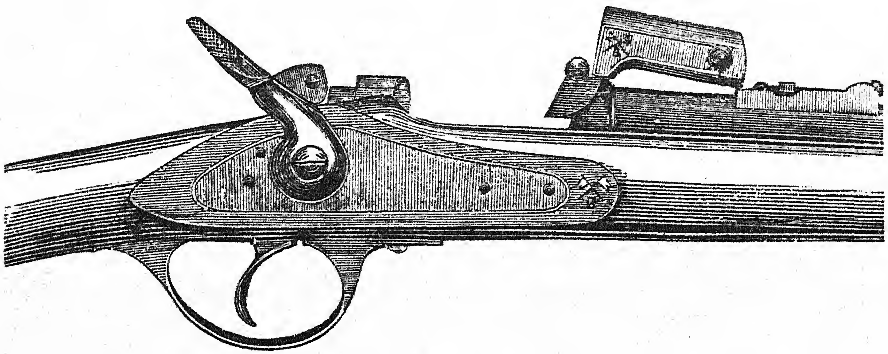


Fig. 112.—The Braendlin-Albini Breech-loading Rifle.

bolt, which passes through the break-off into the breech-block, preventing it from rising at the moment of discharge. This bolt receives the greater part of the recoil, which is more backwards than upwards. The hinge-joint, which is fixed upon the top of the barrels, is merely to carry the breech-block and the extractors, which are fitted on the hinge-pin, on each side of the barrel. When the breech-block is turned upon the top of the barrel, the claws of the extractor are made to eject the empty cartridge-case. The cartridge is exploded by a needle or striker, which is fixed in the breech-block, and is not visible externally when the block is down.

The needle is struck by the locking-bolt, which is worked by the hammer. The Boxer cartridge, or a solid metal case, the same as the Berdan, is suitable for this weapon. The bore is small, being only 443 in the Belgian arm—that is, seven decimals smaller than the Martini-Henry rifle; but it is usually made by the patentees 577, to take the Snider cartridge.

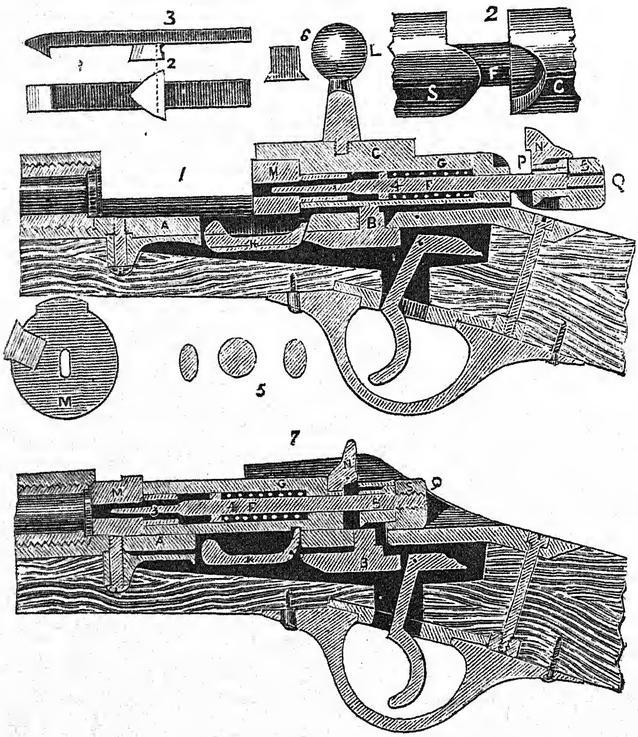


Fig. 113.—The Improved Mauser Rifle.

THE GERMAN MAUSER MILITARY RIFLE.

A new model has finally been approved by the German military authorities, which is based upon the Mauser system, but considerably modified and improved, so that it is now stated to be superior to the Chassepot and the Werder. The principles of this improved Mauser

breech-action will be readily understood from the accompanying engraving (Fig. 113) and the following description :—No. 1 shows the breech when open for loading, Nos. 2 to 6 show various enlarged details, and No. 7 illustrates the safety position, the piece being at half-cock. The bore is 420, or 60 gun-gauge, being rather smaller than the Martini. The Mauser breech-loading rifle is on the bolt principle. The shoe of the breech, A, carries within it the cylinder or breech-piece, C, which is perforated for the striker, F. The breech-piece is worked by means of the lever, L, in the manner of all such guns ; it is furnished with a guide-block on its upper surface, which works between the two lips of the shoe, and prevents rotation of the breech-piece until the guide is clear of the lips or slot. The striker, F, is permanently attached by the nut, S, and screw, Q, to the cocking-piece, which can only move backward and forward, without rotation, in consequence of the following arrangement :—The striker is elliptical in section, as shown in the three sections at No. 5, which are taken at corresponding places in the striker. The face or movable head M is, moreover, detached from the breech-piece, and consequently the rotation of the cylindrical breech-piece in opening and closing does not affect the position of the striker and its adjuncts. The striker is surrounded, as usual, by a spiral spring, G ; the rear end, or the breech-block, acts on the cocking-piece by a kind of cam action, shown in detail at No. 2. The extractor, shown at No. 3, and in section at No. 6, works in a groove in the left side of the shoe, and its position in the movable head of the breech-block is shown at No. 4. K is a supplement to the extractor, called the ejector. It is mounted in the trigger-spring, B, and works through the shoe ; its function is to throw the extracted case out of the breech. A safety-catch, N, is fitted to the cocking-piece. It works upon a spring like the back-sight of a rifle, and when in use drops into the notch in the breech-block, and prevents the striker reaching the cartridge. The action of the gun is as follows :—The breech being open, as in No. 1, the cartridge is inserted ; the breech-block pushed forward till its guide is clear of the slot, then it is turned to the right, by which the breech is closed—the nose of the cocking-piece is then bearing against B, and the striker-spring is consequently compressed. The pressure on the trigger releases the striker, which, impelled by the spring, fires the cartridge. To open the breech and load again, the lever is turned from right to left. The head of the breech-block

and the cocking-piece remain in the same position, for the reasons above given. The cam of the breech-block forces back the cam on the cocking-piece, and cocks the gun. The breech-block is then drawn back, the extractor draws out the empty case, which, striking violently on the claw of the ejector, K, is thereby thrown out of the shoe. It will be noticed from its form, that the ejector is acted upon through its rear claw, that nearest its pivot. A groove is therefore often cut in the lower part of the breech-piece, and it results that the front claw never projects except when the breech-piece is drawn back.

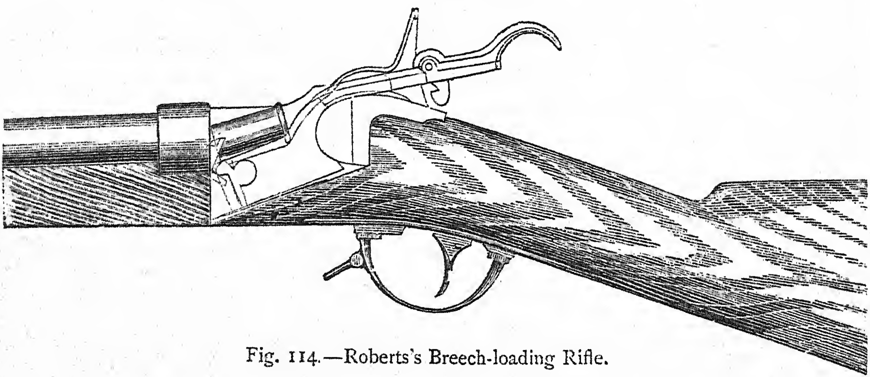


Fig. 114.—Roberts's Breech-loading Rifle.

THE ROBERTS BREECH-LOADER.

This system of breech-action was adopted by the American Government for the conversion of the Springfield rifle. Its simple mechanism is shown in Fig. 114. An iron frame or shoe is screwed on to the barrel. The breech-block is placed in this shoe, and works upon an elbow-joint. The block is extended backwards, forming a lever lying along the grip of the gun. By raising this lever, the front part of the breech-block is sufficiently depressed as to admit of the insertion of a short cartridge into the barrel. The extractor is a curved lever fixed on the left side of the chamber and acted upon by the breech-block when it descends below the cartridge chamber. An ordinary lock and firing-pin are used to explode the cartridge.

THE FRENCH CHASSEPOT RIFLE.

This arm is, in principle, the same as the Prussian needle-gun, but is certainly an improvement both in the action and barrel. The piece is cocked by the thumb, as is the needle-gun; the bolt is then turned one-quarter of a circle to the left, and drawn back: the cartridge is put in and pushed home by the bolt; this bolt is turned back one-quarter of a circle to the right; the piece is then ready for firing. It is loaded when at full

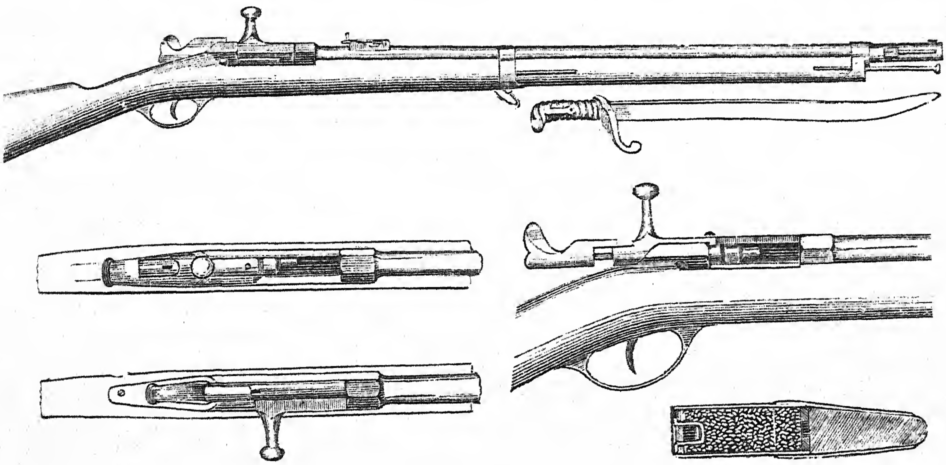


Fig. 115.—The French Chassepot.

cock. To put the rifle at half cock, the bolt must be turned only about one-eighth of a circle. To do this the trigger must be gently pulled, which will allow the cocking arrangement to enter a slot in the bolt-plunger. This movement effectually locks the breech-action, and answers the purpose of a safety-bolt. It can only be fired by bringing it to full cock with the thumb and turning the bolt completely down. The point of the bolt enters the barrel, and is fitted with an india-rubber washer, which partially prevents the escape of gas. Fig. 115 represents this rifle, with the breech-action in separate parts; also the cartridge, which is differently constructed to that of the needle-gun, the ignition being placed in a percussion cap near the base. The needle enters the cap, which is

so placed that the opening is towards the breech arrangement; thus the needle strikes the inside of the cap instead of the outside. The great improvement in the Chassepot is the barrel, which is a small-bore (434), made of steel, and takes the large charge of 85 grains, and a solid conical bullet (weighing 380 grains). The extreme range is 1,800 yards; the weight of the rifle complete with the sword bayonet is 11 lbs.

The barrel is rifled with four deep grooves, having the spiral to the left instead of (as is usual) to the right, with one turn in 21¾ inches. The reason for rifling with the spiral to the left is to counteract the pull of the trigger, which is a very bad one—it drags heavily, and requires a long pull to discharge the rifle.

The bullet for the Chassepot is made larger than the bore of the barrel, is driven through it, fills up the grooves, and prevents windage. But there are several serious objections to this plan. In the first place, it occasions great friction, and much recoil; the barrel also leads very quickly; the bullet leaves the barrel nearly square, which is a bad form for any projectile. For perfect accuracy of flight the bullet should be as nearly cylindrical as possible, and the more even the surface the better. The Chassepot bullet is quite opposite to this, and in this respect resembles the Jacob shell after leaving the barrel.

The cartridge being what is called self-consuming, there is a great escape of gas at the breech; this causes such an accumulation, that after the firing of a number of shots, the manipulation of the breech is impossible without its first being cleaned. There is no lubrication in the cartridge. It is said that the Frenchmen spit on their cartridges, force their fingers into the breech-action, and give every possible sign that, after a few shots, the Chassepot gets so foul that they do not know how to treat it. There is a difficulty in getting the cartridge into the chamber when the rifle is foul; if force is used it becomes dangerous—the cartridge being soft, the percussion cap is compressed between the bullet and the point of the bolt, and has been known to explode in the act of loading, in many cases injuring the hand of the soldier.

The Emperor Napoleon III. appears to have made a mistake in selecting a rifle which fired a self-consuming cartridge. There were several other systems that he might have adopted, viz., the Pottet cartridge, and the Snider, Boxer, or the Berdan metallic cartridge: all these principles were in

use and well known when he decided in favour of the Chassepot. This rifle is still retained in the French army, but it has been converted to take the metallic cartridge.

THE AUSTRIAN WERNDL BREECH-LOADER.

The annexed illustration represents this breech-loader; it is constructed on the block system. The block works on an axis fixed below the bore of the barrel. Fig. 116 shows the breech-action open to receive the

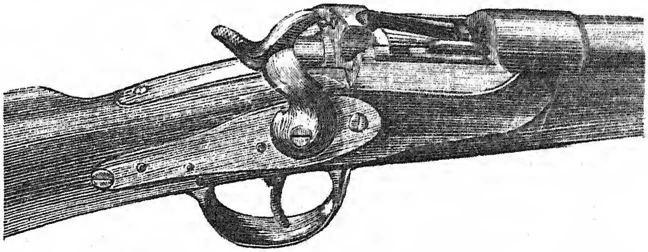


Fig. 116.—The Austrian Werndl Breech-loader.

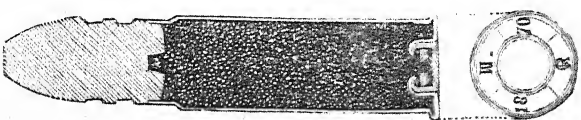


Fig. 117.—The Werndl Cartridge.

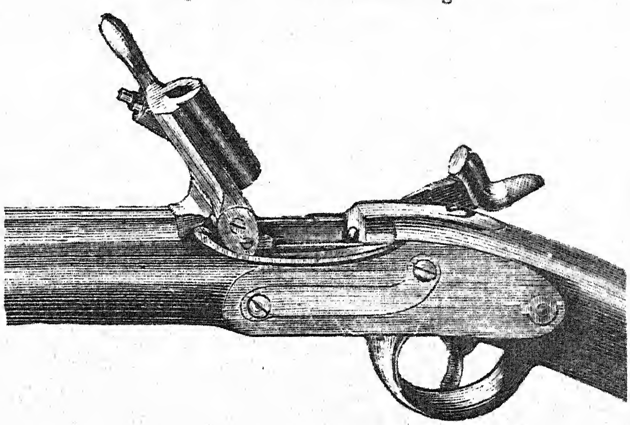


Fig. 118.—The Converted Austrian Rifle.

cartridge, by turning the block to the left, which is accomplished by the thumb: the breech is then closed, and the piece is ready for firing. The cartridge extractor is acted on by the breech-block. The cartridge is brass-drawn, central-fire, and is exploded by the ordinary lock and hammer. It resembles that of the Remington rifle; the bore is the same, viz., 450. The bullet is flat at the point, as in the Winchester cartridge. The Remington rifle and a converted muzzle-loader (Fig. 118) are also used in the Austrian service.

THE SOPER BREECH-LOADING RIFLE.

This rifle is constructed on the side-hinged swinging-block principle, which admits of a cartridge of any length being truly inserted and retracted with its axis in line with the axis of the bore, thus affording great facility

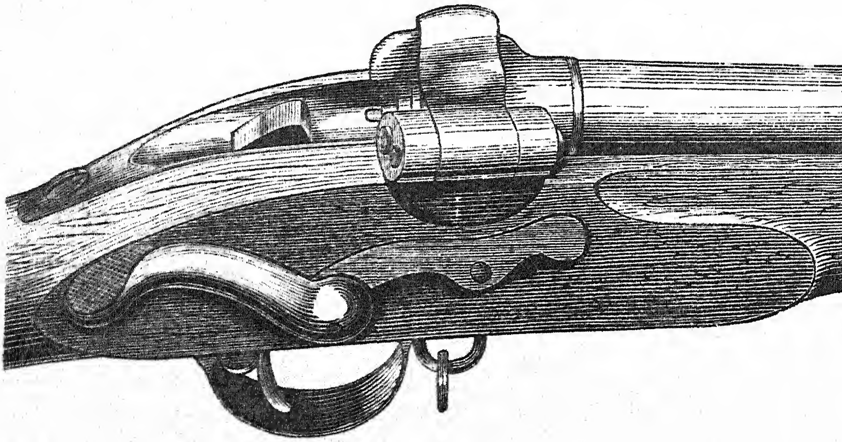


Fig. 119.—The Soper Breech-loader (closed).

for examining and cleaning the barrel. It also combines extreme simplicity in manipulation with perfect safety to the user. It will be seen by the annexed illustration that a lever is mounted on the right side, and so conveniently situated that it can immediately be depressed after the discharge without altering the position of the arm. On the depression of this lever, which moves only 55 degrees in a circular direction, the striker is forced backwards, the breech-block raised, the hammer placed at

full cock, and the empty case ejected. The ease with which this operation can be performed at once explains the marvellous rapidity of fire that has been attained with this rifle.

On reference to the sectional engraving (Fig. 120), it will be seen that the cock, D, which is acted upon by an ordinary swivel and main-spring, H, when released by the scear or trigger, F, delivers a blow upon the striker, G, directly in line with the axis of the barrel.

The striker, G, passes through the centre of the breech-block, A, and is secured and supported in its chamber by an ordinary military nipple, L,

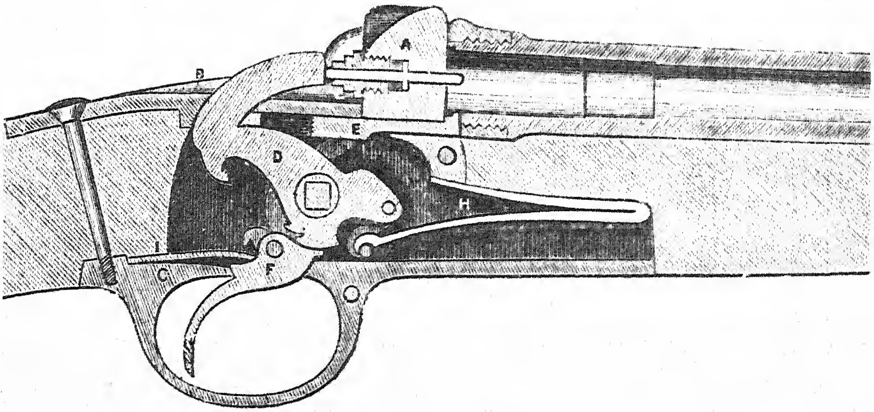


Fig. 120.—The Soper Breech-loader.

which entirely prevents the striker from being driven backwards beyond its proper position. The extractor, E, is fitted to slide in a groove at the top of the lock-plate, and is acted on by a lever which acquires motion from the cock in such a manner that the old cartridge-case is slowly but powerfully drawn from the chamber, and afterwards rapidly ejected from the rifle. The stock is in one piece, and exceedingly strong.

THE WESTLEY RICHARDS FALLING-BLOCK BREECH-LOADING RIFLE.

This rifle is similar to the Martini; but the lever is pivoted in front of the trigger-guard, instead of behind. The arrangement for exploding the cartridge is different: there is no spiral spring, the ordinary main-spring is

used. The hammer, striker, and tumbler are in one piece, and resemble the cock of a central-fire revolver. The nose of the cock is pointed, and strikes the cap through a hole in the breech-block.

The block is supported at the extreme end, next the cartridge, by an arm of the lever, which is in a vertical position. The extractor is a powerful lever, capable of extracting a tight cartridge-case and throwing it clear of the rifle.

The safety-bolt is a cam on the side of the breech-action, which answers

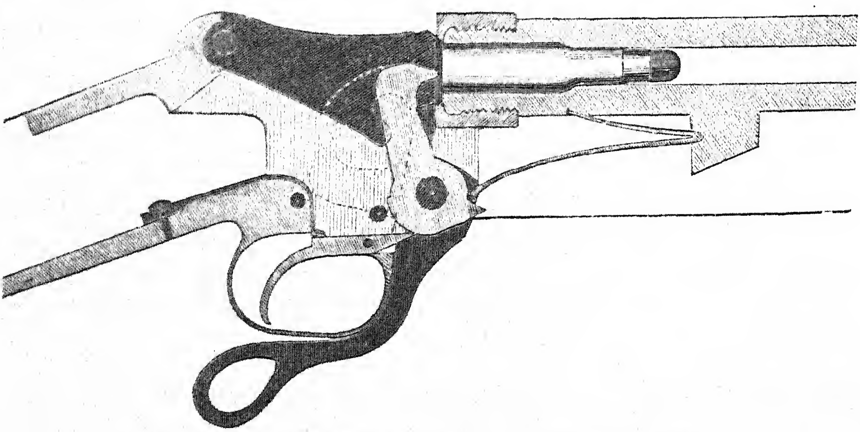


Fig. 121.—The Westley Richards Falling-Block Breech-loader.

the purpose of a half cock. The rifle can be loaded or unloaded with the trigger secured. The cartridge adopted for this rifle is the brass-drawn bottle-necked.

The bullet and rifling are usually upon Henry's plan. The parts are few and very strong, being only fourteen, and seven pins.

A sectional view of the mechanism of this rifle is shown at Fig. 121.

There is another Westley Richards rifle, similar in principle to the one described, but having a horizontal striker and hammer combined, that is acted upon by a V main-spring, which in this case is placed in the rear of the striker, thereby rendering the works more compact. By this means two or three parts are dispensed with, and the process of manufacture is made cheaper and more simple.

THE BERDAN RIFLE.

This rifle is the invention of General Berdan, of the American army; it is a combination of the Braendlin-Albini and the Chassepot. We give an illustration representing it at Fig. 122.

There is a hinged block which turns over the barrel and extracts the cartridge-case. It is locked in position for firing by a bolt resembling the cock of the Chassepot. The lock is worked by a spiral spring. The blow given by the locking-bolt is communicated to a striker working in the breech-block. It is the Braendlin-Albini, with the lock in the centre instead of on the side. This gun is used by the Russian Government. It

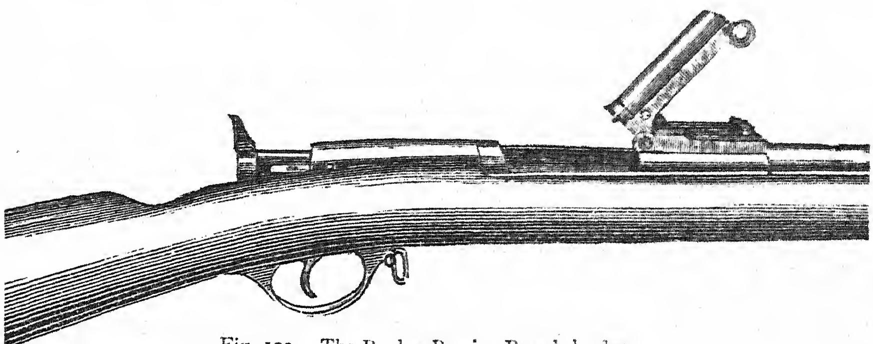


Fig. 122.—The Berdan Russian Breech-loader.

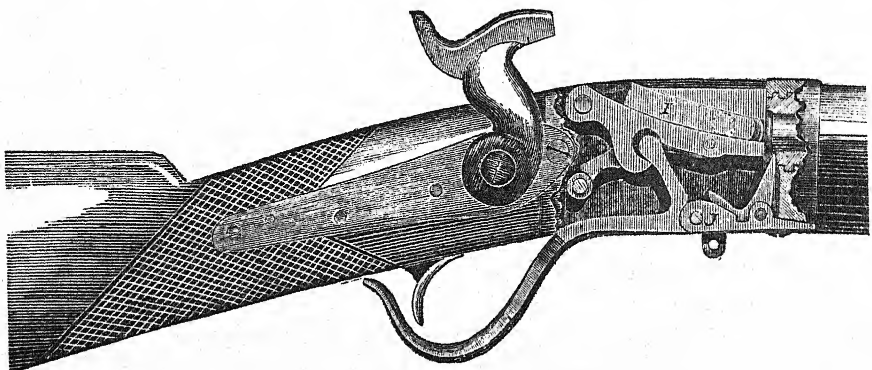
s open to an objection. When loading rapidly the needle is liable to come in contact with the cap and cause a premature explosion, there being no spiral spring to force back the needle. It is a great fault in all breech-loaders constructed on this principle—they expose the base of the cartridge to a dangerous amount of concussion in the act of closing the breech. The bore of the Berdan rifle is small: it takes the Berdan metallic cartridge-case. There is also a new pattern of the Berdan rifle constructed on the bolt system; it resembles the Mauser, and is used by the Russian army, and manufactured at the arsenal of Tula.

THE PEABODY BREECH-LOADING RIFLE.

This rifle is the invention of Mr. H. O. Peabody, of Boston, Massachusetts, United States of America. The essential principles of the gun

were conceived by him some years since, and upon these patents have been issued in America, and in several other countries. The annexed illustration (Fig. 123) represents it.

There is a metal breech-frame or shoe that connects the barrel to the stock, in which the swinging breech-block moves. It is attached to and pivoted at the rear end of the shoe. This block is depressed at the front part of the guard-lever. It will be seen that this guard-lever works on a pivot at the bottom of the shoe (see letter J). There is a projecting arm in continuation of the guard which engages in the breech-block. By depressing this lever-guard the point of the breech-block is dropped below



123.—The Peabody Breech-loading Rifle.

the cartridge chamber. There is a brace-lever placed in a recess in the under-side of the breech-block, being pivoted near the front part. The back of this lever is a spring, so arranged as to press the rear end of the lever firmly upon a roller. This combination of the brace-lever, spring and roller serves to securely fasten the breech-block and guard-lever when the arm is ready to fire.

The guard must be depressed a little more than one inch, to drop the breech-block sufficiently to admit of the cartridge being inserted in the barrel. The breech-block is grooved on the upper side, to coincide with the bore of the barrel when in position for loading. The cartridge is rim-fire, and is ignited by a slide working in the side of the breech-block. This slide is struck by the ordinary lock and hammer. The extractor has

two arms, and is pivoted at the front of the guard, projecting upwards. One point takes the cartridge by the rim, and the other point extends backwards and slightly upwards. When the breech-block is depressed below the bore of the barrel it strikes the short arm of the extractor, and jerks out the empty cartridge shell quite clear of the gun.

This gun was submitted as early as 1862 to the officer commanding the United States Arsenal at Watertown, and was reported upon favourably.

The Peabody rifle appears to be the first of the class having the dropping-block pivoted at the rear end and above the axis of the bore. The chief advantage of this principle is, that the point of the block describes part of a circle, and moves clear of the base of the cartridge at the moment it is depressed, thus effectually preventing any jamming of the breech-block by the expansion of the cartridge at the base, which has been known to occur in rifles constructed like Sharp's, where the whole of the breech-block slides down below the bore. There is also less friction or wear and tear in the rear-pivoted system.

The recoil is received chiefly upon the breech-frame or shoe, immediately behind the pivot, and partly upon the arm of the lever, which has to keep up the breech-block in position for firing. The breech-action of this rifle has been tested by the United States Board of Ordnance with a charge of eighty grains of powder and five balls, with no injury to the gun.

The systems of Martini, Westley Richards, Swinburn, Stahl, Field, and others are like the Peabody in the principle of the breech-block, and all have stood stringent tests as to strength and liability to jam or stick fast with bursted cartridges; their one objection is that they do not permit of a clear view through the barrel, and the barrel consequently cannot be cleaned out from its breech-end. The block has been, and is, worked by variously-formed levers on the side, beneath action, or on top down the hand of the gun—many successfully, owing to the ease with which the block is actuated.

SHARP'S BREECH-LOADING CARBINE.

This is one of the first American breech-loaders. It has been used with great success by the United States army in Mexico, and also during the Civil War. This breech-loader, when first introduced, was used with a made-up linen cartridge, ignited by a percussion cap, and afterwards by an improved magazine primer, called "Maynard's." This was placed in front of the cock, and worked by the hammer in the act of cocking. This increased the rapidity of the arm—it could be fired ten times per minute. The breech-action is a dropping-block; by pressing the trigger-guard, which is fitted with a hinge-joint, downwards, the breech-block is depressed, and allows the cartridge to be inserted in the chamber; the

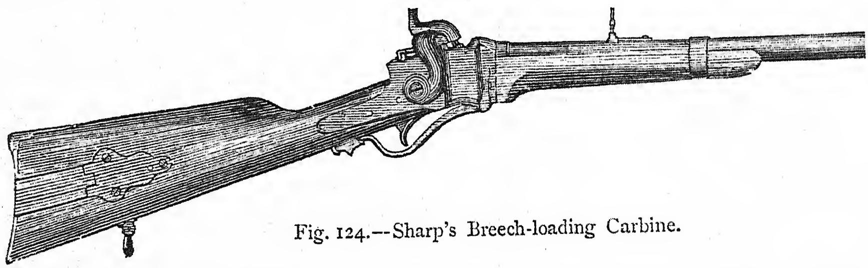


Fig. 124.—Sharp's Breech-loading Carbine.

top edge of which is sharpened, so as to cut off the end of the cartridge, and expose the powder to the igniting flash which passes through the block. This breech-loader was submitted to the American Board of Ordnance at Washington, in November, 1850, who declared it to be superior to any other arm loading at the breech that had up to that date been submitted to them.

Some of the English cavalry were also supplied with Sharp's carbine in 1857, but it was found objectionable on account of the escape of gas at the breech. To such an extent did it escape, that it would burn through a handkerchief if tied round the breech-joint. There is no arrangement to prevent this escape, which is most inconvenient to the soldier, the liability to clogging making it difficult to load after a number of shots have been fired. The Sharp's Company have lately improved this arm by making it take a metallic central-fire cartridge. The appearance of the rifle remains much the same; it is fitted with an exploding-pin and an

extractor; it is 500-bore, and 22 inches long in the barrel. It is also made longer, and fitted with a sword-bayonet for infantry use. An improved model has since been produced, but its manufacture has not, we believe, been continued.

THE HENRY BREECH-LOADING RIFLE.

This rifle resembles the Sharp carbine: the breech is closed by a sliding vertical block, which is depressed for the admission of the cartridge by a lever underneath the trigger-guard. The only difference between the two principles is, the former has the lever and trigger-guard in one piece, and the latter has a separate lever fitting over the trigger-guard.

Mr. Henry has improved this breech-loader by making it self-cocking, and fitting an extractor similar to the Martini. He retains the same breech-block, but entirely dispenses with the side-lock. This reduces the movements to the same number as the Martini. The barrel of this rifle can be cleaned from the breech-end, which is a great advantage, and it can be made any bore, from the ·360 to the ·577 Express.

THE REMINGTON RIFLE.

This rifle was tried at Wimbledon, as long ago as 1866, and attracted considerable attention at that time, in consequence of the extraordinary rapidity with which it was loaded and fired—as many as fifty-one shots

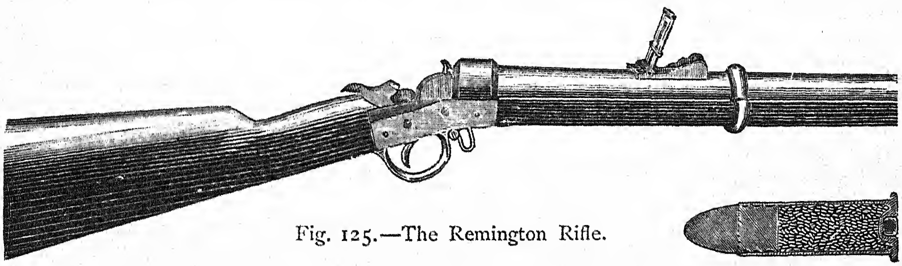


Fig. 125.—The Remington Rifle.

were discharged from it in three minutes, but the shooting was of course very wild. Many patterns of this rifle exist; we shall simply illustrate here the original, preferring to deal with the latest model under the speciality for which it has been produced. The action consists mainly of

two pieces, one being the breech-piece and extractor, and the other the hammer breech-bolt. This breech-piece and hammer-bolt each work upon a strong centre-pin.

The letter A shows the breech-piece closed; B C, the hammer down with the breech-bolt backing up the breech-piece; D, the spring, holding the breech-piece until the hammer falls.

The bore is usually 500, but it is also made 450 for bottle-necked cartridge. At the trial above referred to, it was shot with the small charge of $1\frac{1}{2}$ drams of powder. It is at present made to take a much larger charge (85 grains), and the Berdan cartridge. The breech arrangement is very simple, but it lacks solidity. The method of holding the breech-block up to the barrel is quite original, but it can scarcely be considered truly

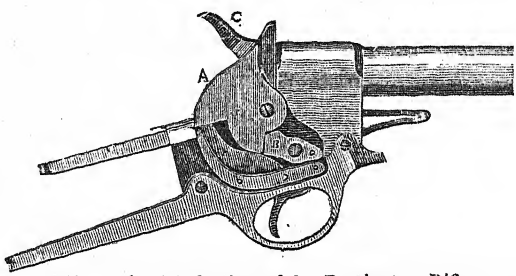


Fig. 126.—Mechanism of the Remington Rifle.

scientific, as the breech-piece should receive its support from immediately behind the cartridge.

This rifle is made in America by machinery, and can be produced in large quantities at a moderate price. It has been extensively used in America, France, Denmark and Austria, and also by the Italian troops, and has given great satisfaction as a military arm.

Most of the breech-actions we have described are, with the exception of the Martini, Soper, and the Westley Richards Capping Carbine, rarely made in England, either as military or sporting weapons. The Westley Richards Falling-Block Rifle, Fig. 121, was for many years a favourite weapon in South Africa, where the Martini, until of late years, and with various improvements, has not been well received.

Another description of breech-action, known as the Swinburn, has also been largely used in the Colonies, and is shown in Fig. 127. It greatly

resembles the Martini in its outward appearance, the hinged block and extractor being identical. The chief difference consists in the lock-mechanism, for in the Swinburn the spiral spring is replaced by an internal hammer and V-mainspring.

The gun is cocked by depressing the lever for loading; a small thumb-lever is also attached to the hammer-pivot, so that the gun may be cocked by it, or it may be lowered to half cock, and again raised when

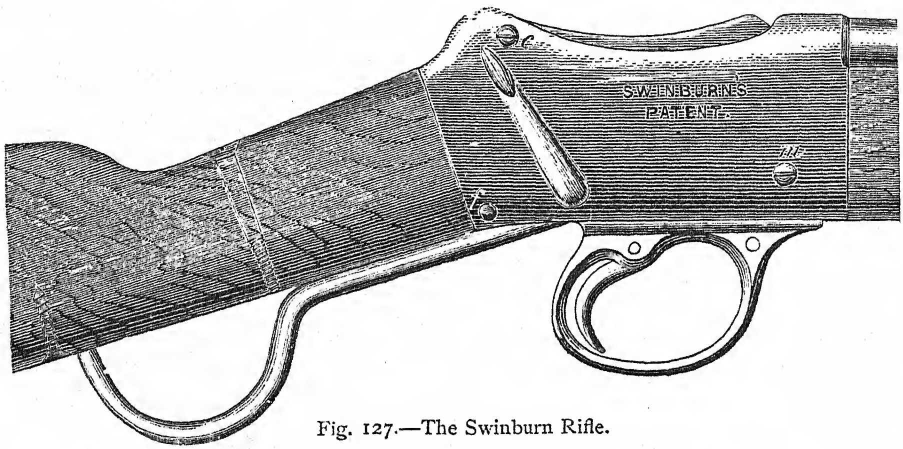


Fig. 127.—The Swinburn Rifle.

game presents itself. This arm may be considered strong and serviceable but of late it has had to give way to

THE FIELD BREECH-LOADING RIFLE,

which is made in two patterns, called respectively the sliding and the hinge-block. The latter is similar to the Martini and Swinburn blocks, but actuated by a side-lever as in the sliding-block pattern shown in Figs. 128, 129.

The chief point in which the Field action differs from all other single breech-actions is that the lever, which is upon the right hand side, is pushed forward to depress the breech-block and raise the hammer. The mechanism of the Field sliding-block action is shown in Fig. 128.

It will be seen that the centre of the hammer-pivot is immediately behind that of the action-lever pivot, so that the projecting breast of the

hammer may rest upon a toe or small cam projecting from the action-lever pivot. The block is depressed by a two-armed cam placed upon the action-lever pivot. A stud upon the extremity of each of the arms of the cam engages with a diagonal slot on each side of the breech-block. Upon the action-lever being pushed forward, the arms of the cam also move forward, and the studs, running up the diagonal slots, depress the breech-block. The hammer is raised at the same time by the toe, on the action-lever raising the breast of the cock, until the scear slips into full cock. When closed, the breech-block is propped up by the armed cam, and the

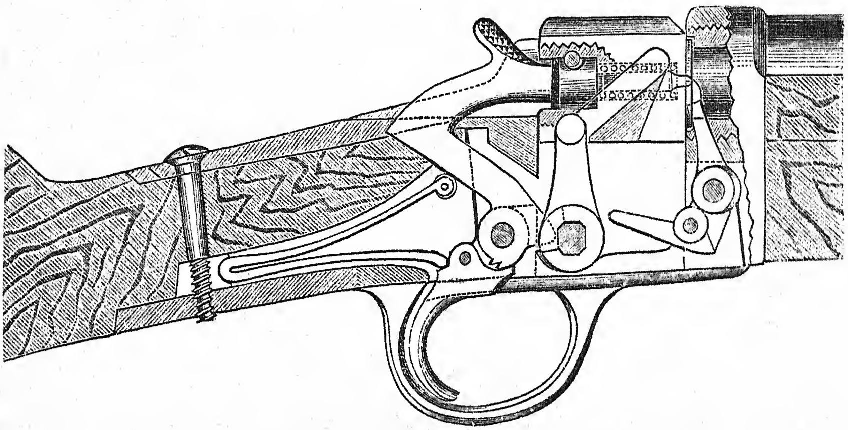


Fig. 128.—Section of the Field Rifle.—Sliding-block Pattern.

lever is kept in position by a small spring fitted on the left side of the breech, slipping into a notch on the arm of the breech-block cam.

The extractor is in two pieces, one pivoted vertically, and having two arms for extracting the case, as in the Martini. The lower extremity of this lever is shaped like an inclined plane, and a lever pivoted at an acute angle to it—having its shorter or lifting end shaped to correspond with the lower extremity of the extractor—is depressed by the breech-block and the case ejected.

The advantages of the compound lever are the greater amount of strength and speed attained compared with the Martini-Henry and similar extractors. The secret lies in the extractor arms moving farther than the lifting-lever. The power is obtained at the commencement by the breech-

block first acting upon the extremity of the lifting-lever only, and the speed by the contact of the two inclined planes.

The hammer is actuated by a V-mainspring, one arm of which also acts as a scear-spring, and the scear and trigger are one.

This action is exceedingly strong and simple, and may be applied to arms of any calibre, and although the position of the lever upon the side of the arm (Fig. 129) and the manner of manipulating the same appears at first strange, one quickly becomes accustomed to it; and its many advan-

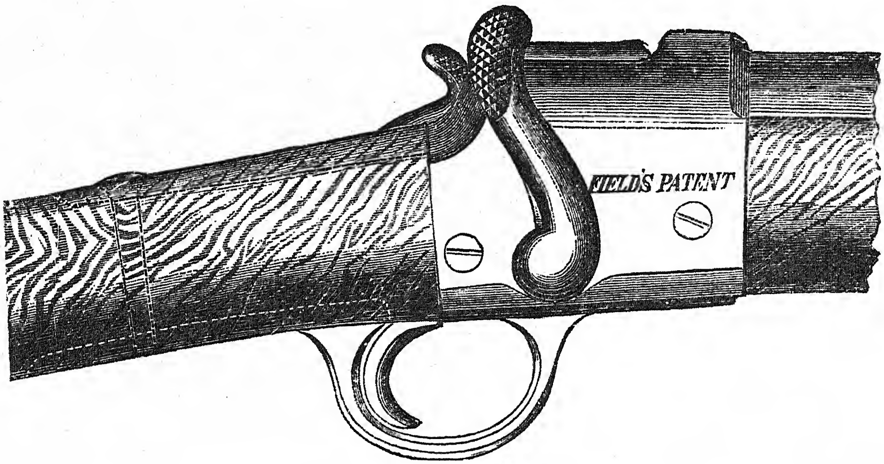


Fig. 129.—The Field Rifle.

tages as a sporting or match rifle action will certainly cause it to be acknowledged as the safest, handiest, and most efficient breech-action yet produced for single rifles.

The Martini also, as now used for sporting breech-loaders, is usually supplied with a safety-bolt, similar to the one shown on Fig. 120. It consists of a circular rod passing through the breech-action immediately behind an arm of the cocking cam. This rod has a flat filed upon one of its sides, and is moved by a small thumb-lever as shown. The safety-rod is so arranged that upon depressing the thumb-lever the tumbler is lifted clear of the trigger; by replacing the thumb-lever the tumbler is lowered into bent, and the gun is ready for firing. Several other safety-bolts have

been affixed to the Martini at various times, but this we consider the handiest and most effective.

M. Francotte, of Liége, has recently manufactured the Martini breech-action in such a manner that the lockwork may be easily removed for cleaning without the use of any tools. To accomplish this, all the lock-work, including the indicator, extractor, breech-block and lever, is attached to the trigger-plate and guard, which is placed in the body of the breech-action from below, and secured there by a pin immediately in front of the extractor-pivot.

This arm is not in the least more clumsy than the ordinary Martini,

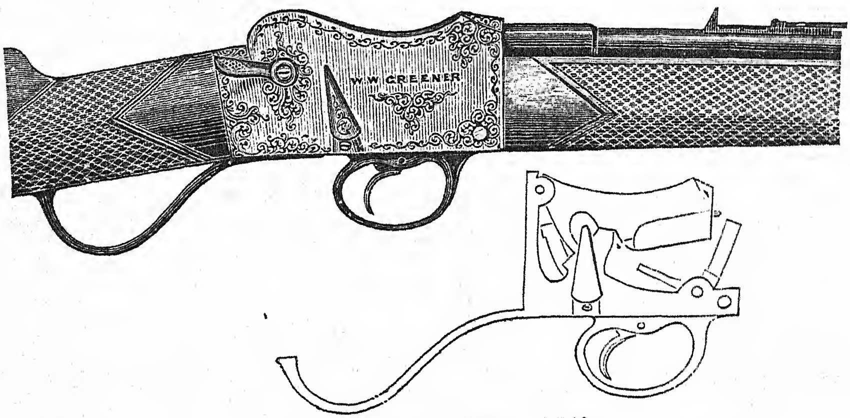


Fig. 130.—The Francotte Martini Rifle.

and is just as strong—the arm of the shoe to which the breech-block is pivoted bedding firmly against the rear end of the body which sustains the whole strain of the recoil.

The difficulty in stripping the Martini, and more especially in replacing the breech-block, rendered it unsuitable for the sportsman in wild countries, but by means of this invention there is no reason why the Martini may not be cleaned and oiled by the veriest tyro.

The parts of this arm, like all others now made by machinery for military purposes, are on the interchangeable principle, and additional limbs, costing but the veriest trifle, should always be taken when hunting in countries far removed from the factory where the gun was made.

Of late several complaints have been made of the Martini action refusing to work in cold latitudes—in Newfoundland, Manitoba, British Columbia, and other countries where the cold in winter is intense, the coil mainspring of the Martini appears to clog through the congealing of the oil or lubricant. We have always distrusted coil mainsprings, and for use in cold latitudes would never recommend one. The only remedy is to strip the arm, and remove the grease by heat, and use the action free from any lubricant, or with petroleum if it is to be obtained.

THE WESTLEY RICHARDS SLIDING-BLOCK RIFLE.

This breech-action, the joint production of Messrs. Deeley and Edge, has, in conjunction with the Metford barrel, been very successful of late at Wimbledon and other match rifle meetings.

Fig. 131.—The Westley Richards Sliding-Block Rifle.

We illustrate the action in Fig. 131. It was originally intended for a military arm, but has not yet been adopted.

The mechanism consists of a vertically-sliding breech-block, which contains the tumbler, mainspring, and other lock work. The guard and lever are in one, and are pivoted to the body of the action, beneath the barrel. By depressing the guard the breech-block descends, as in the Henry carbine the hammer—or rather tumbler—cocked, and the cartridge extracted.

It possesses a signal advantage over the Martini and Swinburn by allowing the barrel to be cleaned from the breech, certainly a desideratum in match rifles.

MATCH RIFLES.

For match rifle shooting, a rifle should always be chosen that may readily be wiped out from the breech; it should be easily loaded and its mechanism simple. Either the Field, the Soper, the Henry, or the Deeley and Edge sliding-block breech-action is applicable to match-rifles, and we do not see that there is any advantage in either for this purpose; for it is the rifling, sighting, and regulation of the arm that makes a perfect match-rifle.

The barrel, which should not be light (certainly not less than 5¾ lbs. in a 10 lb. rifle), is best made of drawn steel, and drilled from the solid—not twisted, as in Double Express rifles and shot-guns. The grain of the metal running parallel to the axis of the bore, enables the grooves of the rifling to be cut cleaner than it is possible to do in a twist-barrel. The rifling adopted in *muzzle-loading* match-rifles (still considerably used) may be either the Whitworth, the Henry, with mechanically-fitted bullets, or the plain square-grooved rifling. The great care required, however, in loading the muzzle-loading rifle, and the risk of having a badly-adjusted charge, render the breech-loader the most serviceable and accurate in the end.

The Metford match-rifling is very expensive to produce, and once obtained requires great care to preserve it from rust and scratches. The rifling itself is done by complicated machinery patented by Mr. Metford, the rifling-tool or cutter being so arranged that it revolves more rapidly when at one end of the barrel than at the other. This is accomplished by the form of the guide-rod, which is set until it describes an irregular parabolic curve. The tool cuts the grooves of a uniform depth, and on an irregularly accelerating spiral, there being a little over a complete turn in the 34-inch barrel. When once rifled, the barrel cannot—as in the Henry, Ratchet, and other riflings—be leaded or otherwise regulated, except with the rifling machine. The *Lands* certainly can be cleaned, but a scratch or spot of honey-comb in the grooves renders the rifle completely useless for match-shooting. In cleaning them, wood rods only should be used. The exact diameter of the Metford Long Range Match Rifle is either ·461, as made by the leading Birmingham and provincial makers, or ·458, as made by Messrs. Westley Richards for their special cartridge.

The cartridge is of solid-drawn brass, slightly compressed or "bottle-

necked," and in both arms 76 grains of powder are used. The bullet weighs 540 grains, has an exact diameter of ·453, with a small hollow at base, and is coiled in paper, which increases its diameter exactly $\frac{8}{1000}$ of an inch, making the diameter of bullet and paper ·461.

The Westley Richards bullet is ·450, with paper wrapping ·458, and weighs 540 grains. Both bullets are cylindro-conoidal in form.

The Metford system substitutes for deep grooves and a soft projectile very shallow grooves and a hardened projectile. The extremes of the new and the old systems of rifling will be seen by reference to the annexed engravings Fig. 132 represents the deep old-fashioned poly-grooved rifling, the grooves purposely cut deep with the intention of their receiving the fouling caused

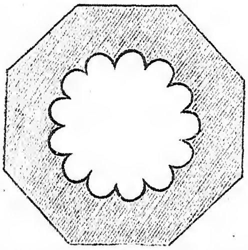


Fig. 132.—Obsolete Deep-grooved Rifling.

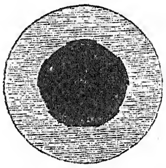


Fig. 133.—Metford Match-rifling.

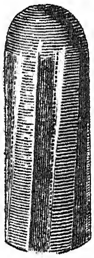


Fig. 134.—Metford Bullet after Firing.

by the explosion. The patch placed round the spherical bullet was supposed to fill these grooves; but this it did imperfectly, and even then the bullet had to be well rammed down, and knocked into the barrel with a mallet.

Fig. 133 is the Metford match-rifle grooving; the grooves, five in number, are very wide, and barely 4000ths of an inch deep. The military pattern grooves are more rounded, seven in number, and slightly deeper, so as to be more lasting. Both styles of grooving scarcely alter the shape of the bullet, which is shown in Fig. 134 after having been fired from a 34-inch match barrel.

The shape of the grooves cut on the bullet when it first started in the barrel is shown by the dotted lines. As the bullet passed down the barrel the increasing spiral altered the original shape of the grooves in the bullet, until when it left the muzzle the grooves were as shown in Fig. 134.

We believe that the expansion of the bullet is not complete until it has

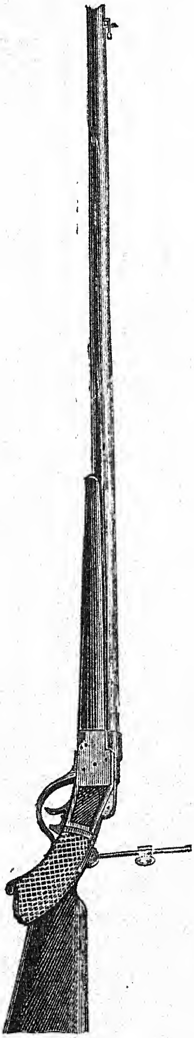


Fig. 135.—Sharp's Long-Range Rifle.

passed a considerable distance down the barrel; but as the bullet approaches the muzzle the expansion becomes perfect, and it receives the full effect of the sharp spiral—1 turn in 17 inches—with which the Metford rifling finishes.

Mr. Metford constructs his rifling and irregularly increases the spiral, according to various formulæ, based upon the theory that gunpowder of a given size and density generates its strength irregularly, and that more powder is burnt in one given portion of the barrel than other given portions of equal capacity, and that therefore the rifling at a given point must have the amount of spiral in proportion to the strength of the powder generated at that point. But we would call attention to the fact that Mr. Metford's rifling shoots equally well with powders differing considerably in their quickness of combustion, and that therefore the theory of the grooving being in proportion to the strength of the powder appears shaken.

The grooving employed in American match-rifles appears to us to be based upon the best theory, and we believe it will ultimately surpass all other systems of rifling.

The leading American match-rifle makers all rifle upon the same plan—viz., a sharp continual spiral and very shallow grooves.

Mr. Rigby has adopted this plan for nearly all his match-rifles, and this rifling has in several cases surpassed the Metford. The amount of spiral is 1 turn in 18 inches; the hardened bullets expand and fit the grooves perfectly, and are not altered in shape by the increasing spiral, as in the Metford. To Mr. Metford is due the honour of producing in this country the system of the shallow grooves and the hardened projectile. Before he perfected this system, Mr. Rigby and other rifle-makers used deep grooves

and soft lead bullets, following in the wake of Mr. Whitworth, who undoubtedly was the first to produce a lengthened projectile that would perform successfully. Between Mr. Whitworth's and Mr. Henry's rifling there is very little difference, and both are now out of date. The Metford principle is less liable to the one great fault of accelerating spiral grooved rifles than those having deep or well defined grooves. The principle of the accelerating-spiral is no new thing, the Lancaster oval bore was so constructed, and many essays have been made previous to its introduction, which the one common fault was the jamming of the bullet in the barrel, at the point where the projectile acquires a proportional increase of velocity. A slow burning powder gives better results with the Metford, and the hardened bullet overcomes several objections previously made to the system. A principle can hardly be sound that has for its basis the affecting of a body in rapid motion, or a force inferior to the primary force.

In the Sharp's rifle (Fig. 135) shallow grooving is employed; the breech-action is similar in action to that illustrated in Fig. 114, but the breech-block is longer, and contains the lock mechanism, which consists of a spiral-spring arrangement. When cocking the gun, by depressing the guard the lock-work is bolted, and must be freed by pressing the small second trigger before the gun can be fired.

The Remington match-rifle has a similar breech-block to the Sharp's, but it is actuated by a lever on the side.

In match-rifle shooting it is now the custom—especially with the Americans—to place the bullet in the chamber separate from the cartridge case, and push it into the barrel with the cartridge loaded and wadded to the top; but in any case the bullet should not be placed deep in the cartridge case—⅛th of an inch is sufficient—and it is better if the bullets be carried separate from the cartridges, and only placed in them when ready to load the rifle. All breech-loading rifles load much easier immediately after firing.

The powder used is either the military No. 6 grain or a separate powder made for match-rifles. This powder being made purposely from inferior charcoal, fouls the barrel very much and burns slowly.

The charge of powder for a match-rifle varies. For the military Martini-Henry it is 85 grs., for the military Metford 76 grs., for the match Metford 90 grs., for the ordinary shallow-grooved match-rifle 95 grs.

Fig. 136.—The Farquharson Match Rifle.

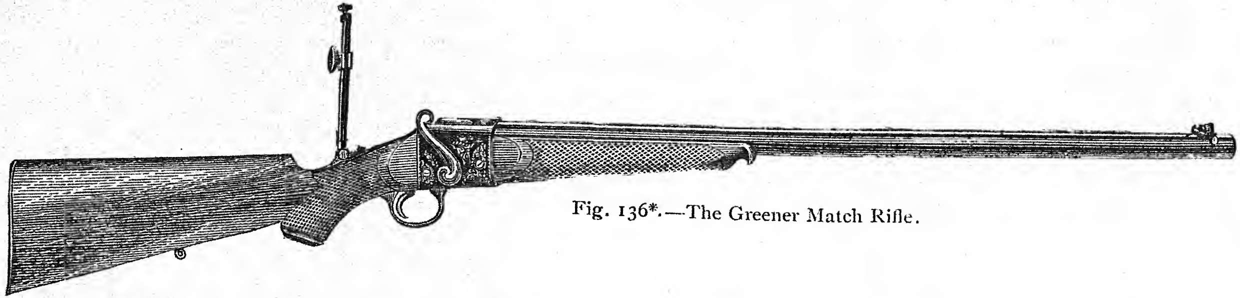


Fig. 136*.—The Greener Match Rifle.

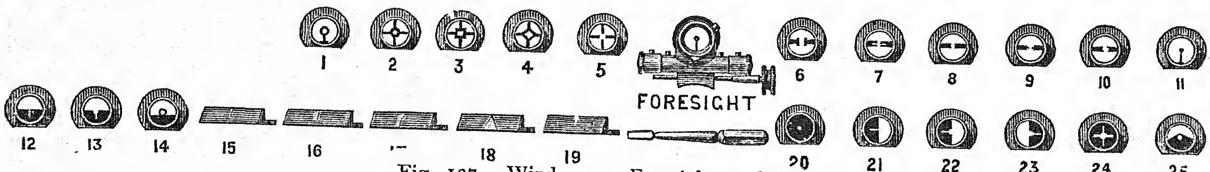


Fig. 137.—Wind-gauge Foresight, and Discs.

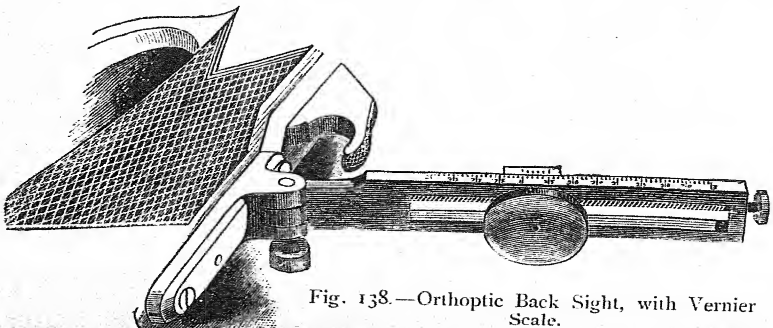


Fig. 138.—Orthoptic Back Sight, with Vernier Scale.

These charges are with the ordinary No. 6 rifle grain. If the slower-burning special powder is used, the charge for match-rifles is about 105 grs.

In match-rifles the paper in all cases should drop from the bullet immediately it leaves the muzzle; if it adheres to the bullet it retards its flight, or, as is often the case, becomes partly uncoiled and acts as a rudder to the bullet, causing it to swerve, and thus shoot wild.

We show in Fig. 136 a match-rifle with sights for long-range shooting, pistol-grip to the stock, and the Gibbs and Pitt breech-action; it is more generally known by the name of the Farquharson Rifle.

The sights for match-rifles consist usually of wind-gauge foresight, and an elevating Vernier peep-sight affixed to the stock of the rifle, as shown in Fig. 138.

The foresight (Fig. 137) usually consists of a hood affixed to a sliding bar, which is dovetailed into a saddle soldered to the barrel, and capable of laterally traversing the saddle by means of thumbscrews affixed to it. The bar of the sight and one surface of the saddle are marked with the Vernier scale, enabling perfect adjustment for wind or drift. A spirit-level is affixed to the saddle, immediately in front of the hood or holder in which the disc is placed, so that it may be seen by the shooter at the moment of firing.

The discs are of various patterns, to suit the different ranges and atmospheric changes. In Fig. 137 we represent a match-rifle foresight, with twenty discs, five bars, and the small turnscrew required to change the discs.

According to the rules of the National Rifle Association, patterns 1 to 19 are permitted to be used at Wimbledon, whilst patterns 20 to 25 are prohibited, on the ground of hiding from the shooter any signal that may be made at the targets.

The discs most in favour in clear weather are the calliper discs Nos. 6, 7, 8, 9 and 10. In using them the bull's-eye is brought between the bars, and equi-distant from each corner and extremity of the bars. The hollow bead No. 1, or Nos. 2, 3, 4, 5 and 14 are also considerably used. In these sights the bull's-eye is brought inside the aperture, a rim of white being left, of equal thickness all round, between it and the sight. When the split and Goodwin bars, Nos. 15, 16, 17, 18 and 19, are used, the split, or mark, is brought immediately beneath the bull's-eye. Nos. 12 and 13 are modifica-

tions of the bar sight adopted for use in the discs; No. 11, the solid bead, is only used in a bad light, and is centred on the target, and in aiming it covers the bull's-eye.

The skeleton discs, Nos. 1 to 5, must be constructed of metal not

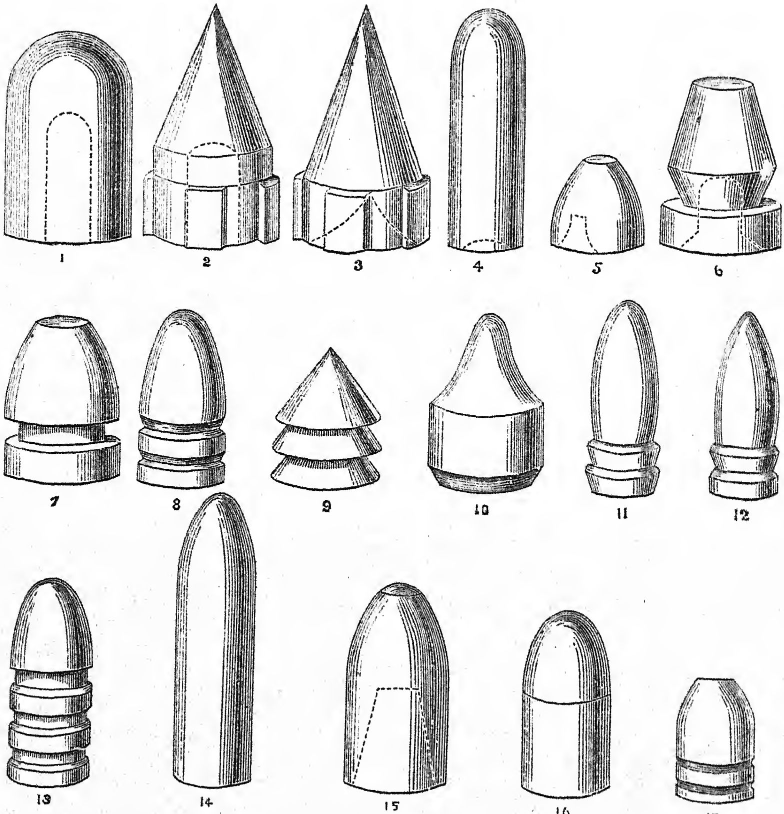


Fig. 139.—Rifle Bullets.

thicker or broader than ·03 of an inch, and in the calliper sights, No. 6 to 10, the width of the bar must not exceed ·08 of an inch, but the discs may be used vertically, instead of horizontally, if preferred. The backsight, Fig. 138, known as the orthoptic or peep-sight, consists of blued steel discs, with a small aperture in the centre, the disc travelling vertically on a

tangent, and elevated by a thumbscrew, according to the Vernier scale marked upon the bar of the disc and the side of the tangent. In best sights the tangent is inlaid with platina on the Vernier edge and other working parts. In military rifles a tangent and sliding Vd. bar are used in lieu of the peep-backsight.

The projectile used in match-rifles generally consists of an elongated bullet, cylindro-conoidal in form. This projectile is technically called a "picket," and has been gradually developed from the oval projectiles of the last century. The bullet which we show in Fig. 140 is devoid of cannelures, and although cupped at the base as in Fig. 134 it expands very slightly, hardly 5000ths of an inch, and leaves the muzzle perfect in form. We show in Fig. 139 various projectiles that are, or have been, in use for long-range and military rifles.

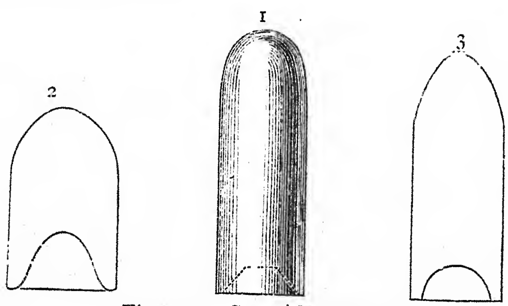


Fig. 140.—Cupped Rifle Bullets.

No. 1 is one of the earliest forms of the cylindro-conoidal bullet; Nos. 2 and 3 are early French and German mechanically-fitting conical bullets, with hollow or cupped bases; No. 4 is the Martini-Henry regulation bullet; Nos. 5, 6, and 7 are bullets used by the French during, and for a short time after, the Crimean War; Nos. 8 and 9 are German bullets, with deep cannelures; No. 10 is a Sardinian bullet; Nos. 11 and 12, Swiss long-range cannelured bullets; No. 13 is the bullet used in the United States Service, and No. 14, the American Long-Range Rifle "Picket"; No. 15 is the modification of the Miniè bullet, adopted for use in the ·577 Sporting Snider Rifle; No. 16 is the ·450 wrapped carbine bullet; and No. 17 the flattened ·44 bullet used in the Winchester Repeating Rifles.

No. 1, Fig. 140, is the Whitworth bullet, as made for breech-loaders, and

not mechanically fitted; No. 2 is the last modification of the Minié bullet —the cupped base expands by the force of the explosion and requires no plug; No. 3 is an outline of a long-range ·450 bullet, which acts upon the same principle.

In constructing a rifle-bullet the desiderata are perfect symmetry and uniform density of the metal employed, so that the bullet may offer but little resistance to the atmosphere, and not have its polarity counterpoised by the weight being unequally distributed; all bullets should be heavier forward, if they are to maintain a pointed flight, and not turn over and strike the target base first, but this tendency may also be overcome by giving a sharp and continued rotary motion to the projectile by the rifling.

Bullets, as the Macleod, and others which rotate by the pressure of the atmosphere, offer more resistance, which so retards their flight as to counteract any advantage in precision which the rotary motion may cause.

MATCH-RIFLE SHOOTING.

It is possible that a well-made rifle, with the most approved appliances as to sights and ammunition, is capable of registering the highest possible score at 1,000 yards—that is, a mean deviation of less than 1·75

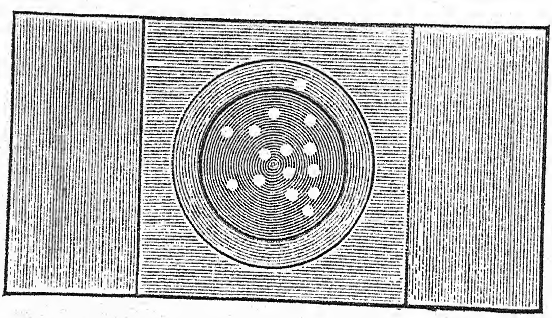


Fig. 141.—Diagram of Dr. Scott's Target at 1,000 yards.

feet. At Dolly Mount, during the visit of the American Team to Ireland in 1880 for the International Match, Dr. S. J. Scott made an extraordi-

nary target at 1,000 yards, scoring 74 out of a possible 75. Fig. 141 is an exact facsimile of his target. During the same match Colonel F. H. Clark and Mr. R. Rathbone scored a "highest possible" at 900 yards.

In the Irish Team the highest score at 1,000 yards was 72 out of a possible 75, and two only highest possible scores were made by this Team, and both at 800 yards.

In this match, rifles of the most approved make were used, the sights and appliances *ad libitum.*

Next to the scores above given, perhaps the following are the highest well-authenticated scores made in this country.

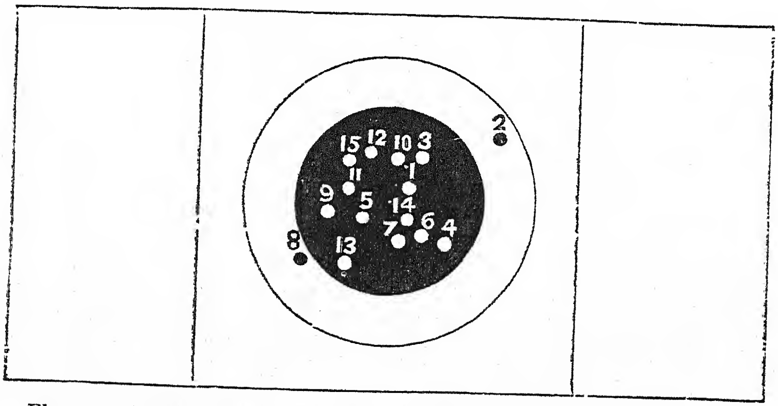


Fig. 142.—Diagram of Target made with a Farquharson-Metford Match-Rifle..

Fig. 142 is an exact representation of a target made by Major S. S. Young, at the Hounslow range, August 13th, 1879, 15 shots at 1,000 yards, with a Farquharson-Metford breech-loading match-rifle, 10 lbs. weight, using the most approved appliances as to sights and ammunition, and wiping out after each shot, value of points, 5, 4, 5, 5, 5, 5, 5, 4, 5, 5, 5, 5, 5, 5, 5 —73 out of a possible 75.

The best score we can record with military sights and ammunition, and without wiping out the barrel, is that of Major S. S. Young, at the Hounslow range, November 4th, 1879, with a Field-Turner military rifle, of 9 lbs. weight. We append a diagram of his score (Fig. 143), for comparison with

the diagrams of match-rifles already given. The value of the score is as follows :—4, 5, 5, 5, 5, 5, 4, 5, 5, 3, 4, 5, 5, 3, 5—68 out of a possible 75.

A recent animated discussion respecting the relative merits of the breech and muzzle-loading systems for match-rifles has been to little practical purpose. The question has been again and again threshed out, and invariably in favour of the breech-loader.

Numerous facsimile diagrams of targets made with both breech and muzzle-loading rifles have been sent to the editors of the American

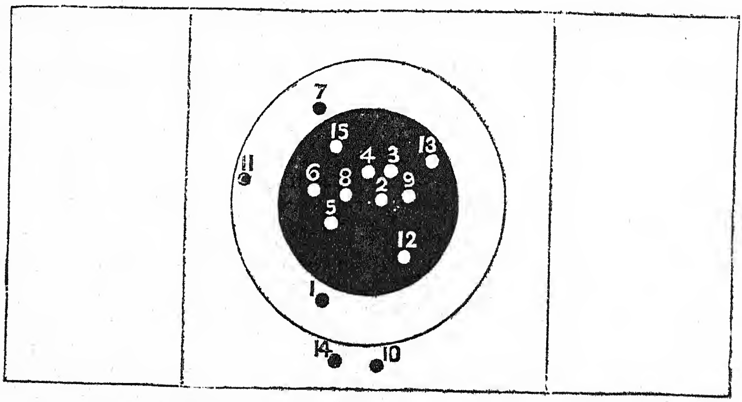


Fig. 143.—Diagram of Target at 1,000 yards, with Military Rifle.

sporting journals, all of which, if fully reliable, would not be adequate proof of the superiority of one rifle over the other—merely evidence of good markmanship.

The best target—and a splendid one it is—made by C. Gove, of Denver, Colorado, is here reproduced, was made with a muzzle-loading target-rifle, weight 45 lbs., calibre ·500, conical bullet, telescope sights, distance 100 yards, a string of ten shots, with an average deviation of ·40 inch only, or shooting passing in accuracy the winning miniature match-rifle at the "Field Rifle Trials of 1883." But the rifle is simply useless for sporting purposes.

The Wimbledon targets, which are now almost entirely used throughout England, are of the following sizes:—

Value in Points.	Designation of Division.	Dimension of Division and Targets.		
		Third Class. 200 yds.	Second Class. 500 and 600 yds.	First Class. 800, 900, and 1,000 yds.
5	Bull's-eye	8 inches Diameter	2 feet Diameter	3 feet Diameter
4	Inner	1 foot ,,	3 ,, ,,	4½ ,, ,,
3	Magpie	2 feet ,,	4 ,, ,,	6 ,, Square
2	Outer, *i.e.* remainder of Target	4 feet Square	6 ,, Square	12 ,, by 6 feet

The method of marking is as follows ;—

Bull's-eye ...	White Disc.
Inner ...	Red Disc.
Magpie ...	Black and White Disc.
Outer ...	Black Disc.
Ricochets ..	Black Bar.
Cease Firing ...	Red Flag.

Misses and shots outside the outer line not signalled.

A few notes on the peculiarities of the Wimbledon range may be of some use to intending visitors. The range, although situated in the centre of a comparatively flat district, is subject to most unsteady and even treacherous winds. All over the common flags are placed to denote the wind's direction, but they often blow in contrary ways, putting even the best shots to their wits' ends. Upon the flat ground, where the targets are numbered off from 1 to 40, the wind is more regular, and it is best to follow the indication of the flags at the butts, and take no notice of the flags at the council-tents, which often blow in the opposite direction. On sunny days the light is also very trying ; the sun during shooting hours is almost in front, dazzling the eyes and partially obscuring the targets by its glare.

Near the Wimbledon entrance at the 200 yards' range the wind is very trying, but as a rule a right wind is much more steady than a left wind.

Some competitors make a great mistake by sighting and regulating their rifles at the Pool Targets for the matches at the Queen's Targets ; the light, angle, and the wind, at the two sets of targets differ so considerably that it is impossible to gauge one by the other.

The scientific knowledge required to become a successful rifle-shot necessitates much study, and continual practice with the weapon is also called for. The successful rifle-shot must be master of the Vernier scale, the barometer, refraction, mirage, and all atmospheric changes, thoroughly conversant with the natural deviation and trajectory of his rifle, and careful to note all changes in the force and direction of the wind.

Amongst the errors which riflemen make, few are more frequent than unnecessary haste both in shooting and adjusting the sights. The notion that another man is waiting to fire should not for a moment be thought of, and to fire when in an uncomfortable position is the height of folly. The only successful plan is the fixed determination not to fire until the accuracy of the aim is placed beyond a doubt.

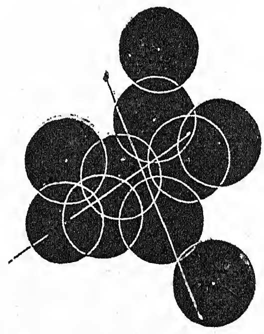


Fig. 144.—Diagram of Mr. Gove's Target.

In adjusting the sights, among other items the following must be borne in mind: the density of the atmosphere, the elevation of the shooter and the target above the sea level, refraction, mirage, the force and direction of the wind, and the drift of the bullet. Due allowance must be made for all these points, so that the adjusting of the sights will require much calculation and considerable time.

The next point will be to obtain a good position, on which also success in a great measure depends. Off-hand shooting is now only practised by the English at short ranges. The proper way is to grasp the rifle at the first band; the body should not face the target, but stand well to the right, in order that the rifle may cross the body and its weight be evenly balanced;

the legs should be well apart and braced up; the chest well thrown back, so that the heel-plate may be firmly embedded in the hollow of the right shoulder; the chest should be drawn back until the back is well hollowed; and the grip, especially that of the left hand, should be firm in the extreme, with the left elbow well under the rifle and the right horizontal; this keeps the rifle in a perpendicular position, without which all sighting is of no avail.

At long ranges the favourite position is to lie full length on the stomach, both elbows rest on the ground, and with the heel-plate bearing against the collar-bone. This position is the steadiest for all inclined to

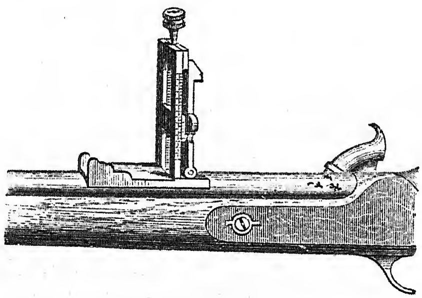


Fig. 145.—Murcott's Vernier Sight Elevator.

corpulence, and is especially easy. Other fancy positions are no longer permitted by the Rifle Association.

The broad Switzers rest the left elbow on their massive chests, and stand with their legs well apart, but these people are gifted with an extraordinary power of holding their breath, so that perfect steadiness is not impossible with them in that, to us, exceedingly awkward position.

The recoil with a 10 lb. match-rifle is inconsiderable, and both on the Continent and in the United States ladies take part in the tournaments. The ladies' day at Creedmoor is highly interesting, and creditable scores are frequently made.

In using military rifles at the butts great advantage may be gained by the use of the Vernier gauge. This useful little instrument, introduced by Mr. Murcott, consists of an accurately-fitting sliding-bar, traversing a stand

by means of a thumbscrew, the edge being marked with the Vernier gauge. The manner of adjusting this instrument is shown in Fig. 145.

The Vernier is always placed at the back of the flap when upright, and catched under the sliding-bar, which is slowly raised by turning the screw at the top. The slide should never be put down on the Vernier, but should be placed several 100ths lower than it is intended to be used, and screwed up to the mark.

The Vernier admits of the military sight being adjusted to the 200th part of an inch, and by means of tables supplied with the instrument, it is very easy to calculate the exact height at which the bar should be placed. All genuine Verniers are marked "T. Murcott," and may be had at 68, Haymarket, London. Spurious and faulty Verniers are the cause of many mistakes and much annoyance.

REPEATING OR MAGAZINE RIFLES.

The Spencer appears to have been the first successful rifle constructed according to this plan; it was patented on the 6th of March, 1860, in the

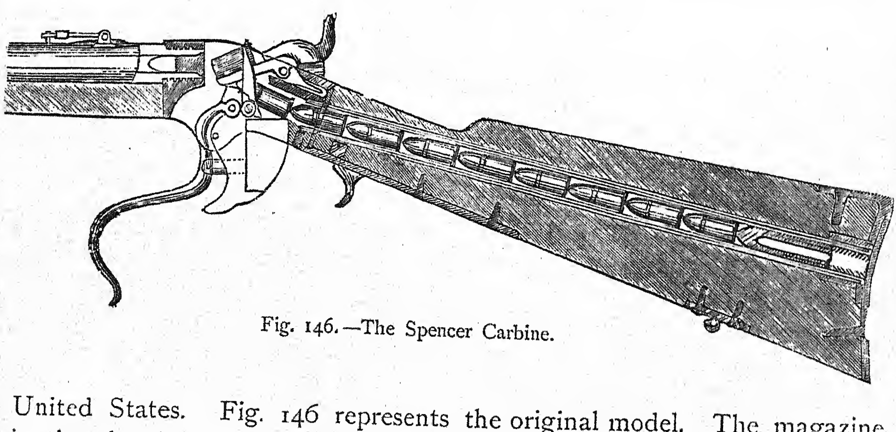


Fig. 146.—The Spencer Carbine.

United States. Fig. 146 represents the original model. The magazine is in the butt. To load, the muzzle is pointed downwards, the magazine lock is turned to the right, the inner magazine tube is withdrawn, the cartridges are dropped into the outer magazine, ball foremost, then the tube is inserted and locked. There is a spiral spring fitted in

the magazine, which forces the cartridges up to the breech-chamber. The first cartridge is forced forward into the chamber of the barrel by moving the guard-lever downwards, as shown by the engraving, and immediately drawing it back. It can be loaded with the hammer down, but should be kept at half-cock while the cartridge remains in the chamber. To fire, bring the hammer to full-cock, and by pulling the trigger, it strikes the percussion slide, forcing it against the rim of the cartridge, and exploding it. The discharged shell is withdrawn by the opening motion; there is a carrier-block that moves the shell-drawer over the cartridge guide, which is then depressed by a spring. This same guide aids in conducting the new cartridge to the chamber. It can be fired seven times in ten seconds, but only fifteen times in one minute; it can also be used as an ordinary breech-loader. This rifle was used with great success in America during the Civil War. It was considered that one man armed with the Spencer was equal to five or six armed with muzzle-loaders.

This arm is now made to cock by opening the lever, and the introduction of a new model is mooted, which will take a more powerful cartridge and offer greater facilities for charging the magazine.

THE HENRY REPEATING RIFLE.

This rifle has a magazine under the whole length of the barrel, and contains fifteen charges. The gun is manipulated in two motions; it can be loaded and fired thirty times a minute. By depressing the lever-guard, and bringing it back quickly, the old case is extracted, the rifle is cocked, and a new cartridge inserted in the chamber. The magazine is a rather delicate arrangement; it was improved upon considerably and superseded by the Winchester rifle, of which we give a description. This gun too was used in the Civil War, by the Federals, and with considerable success.

THE WINCHESTER REPEATING RIFLE.

This rifle, so far as the mechanism for loading and firing is concerned, is precisely the same as the Henry, except in the form of the cartridge-extractor and magazine. The improvements consist in the methods and appliances for loading and unloading the magazine. By these changes the

gun is made stronger and lighter, the magazine is closed and strongly protected, is more simple in operation, and requires fewer motions to fill.

The magazine tube containing the cartridges is placed under the barrel. The cartridges are put in point first, and forced up to the breech by means of a spring. It is impossible to put the cartridge in the wrong

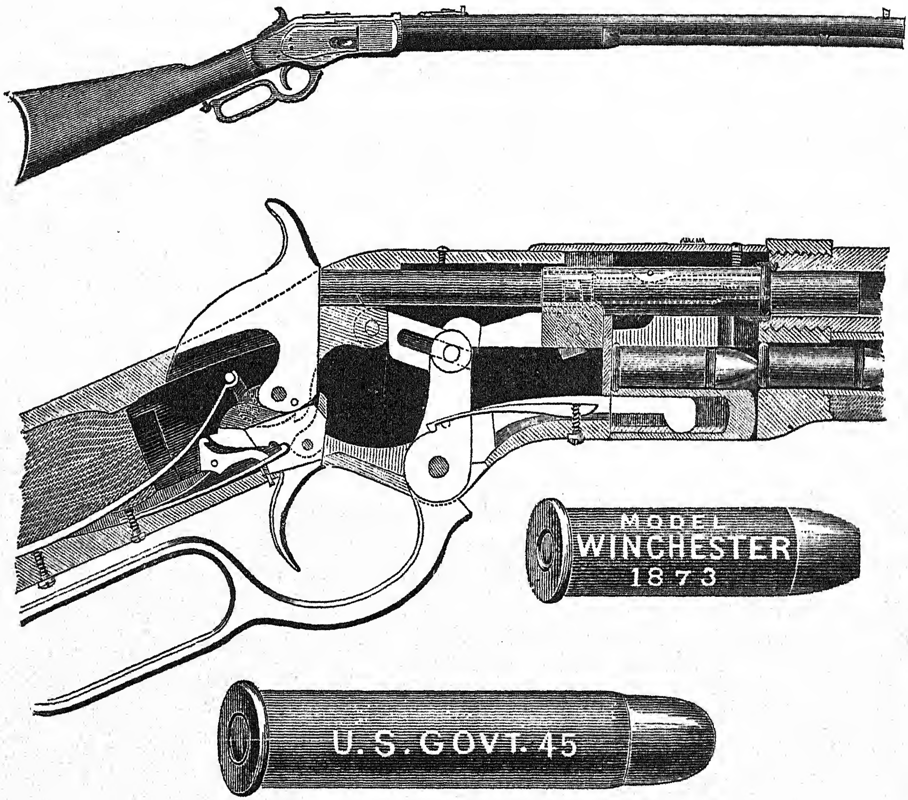


Fig. 147.—The Winchester Repeating Rifle and Cartridges.

end first. The magazine is always replenished at the breech-end, and that without changing the normal condition of the gun. One advantage is that it can be loaded as an ordinary breech-loader, and fired thirty times per minute by an expert.

The action is as follows: The lever is depressed so the cartridges may be pushed into the magazine point first, each cartridge as it enters compressing more and more the coil spring in the tube; the magazine when filled, with 13, 15, or 17 cartridges, as the case may be, is closed, the lever brought home, and the carrier depressed into a line with the magazine from which a cartridge is pushed on to it by the coil spring; the lever must then be again actuated to convey cartridge to the barrel chamber.

On closing it before firing, the spring throws another cartridge upon the carrier-block, which, by a forward movement of the trigger-guard, is raised to a level with the chamber; the hammer by the same movement being carried to full-cock. A reverse movement of the guard, bringing it to its place again, forces the cartridge into the chamber, and the gun is again ready to fire.

The direction in which repeaters err is complexity of construction. If this difficulty could be overcome, the advantages over the breech-loader would be considerable, not merely for the cavalry and artillery, where an intensely rapid fire is generally required for a few decisive moments, but for the universal equipment of troops. But it is not probable that repeating arms will become general in their present complicated form; their liability to get out of order more than counterbalances the advantage gained by rapidity. Durability is one of the first considerations in a military breech-loader. Long range and low trajectory, combined with accuracy, are other important qualities which the repeating arms do not possess, owing to the small charges of powder and short bullets that are used in the cartridges, which conditions are necessary to admit of the quantity to be carried in the magazine. The breech-action of these rifles is not calculated to stand the strain of heavy charges such as are used in the Martini.

Several models of the Winchester Repeating Rifle have now been manufactured. The 1873 model is 440 bore, and fires the cartridge shown on page 176, with 40 grs. powder, and solid, flat-pointed bullet weighing 200 grs. The rifle is made in two lengths; the longer is 3 ft. 8 in. over all, weighs $8\frac{1}{2}$ lbs., and has a magazine for 14 shots; the smaller is 3 ft. 3 in. over all, weighs $7\frac{1}{4}$ lbs., and has a magazine for 12 shots. The 1876 model is similar in mechanism to the 1873 model, but the cartridge is the United States service cartridge and the bore 450. The charge is 75 grs.

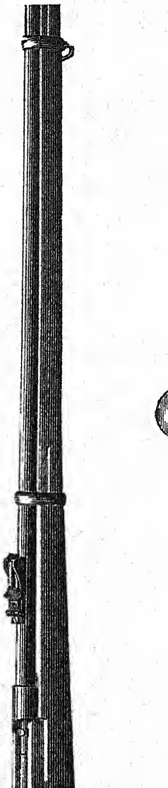


Fig. 148.—Hotchkiss Magazine Rifle.

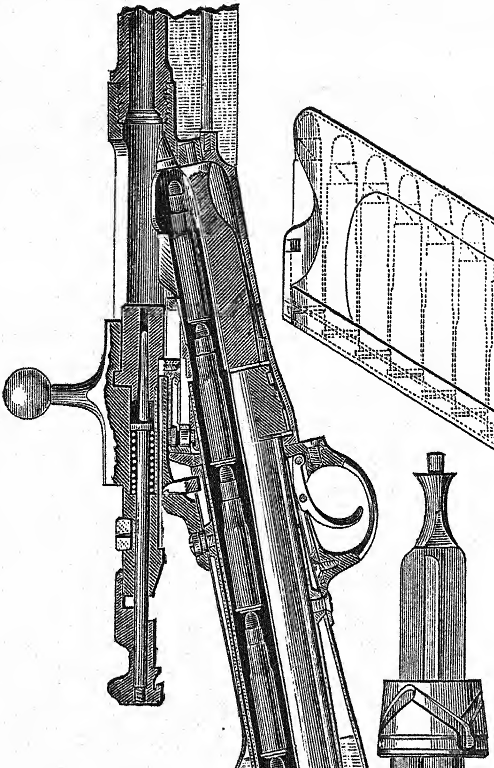


Fig. 149.—The Mannlicher Revolving Magazine Repeater.

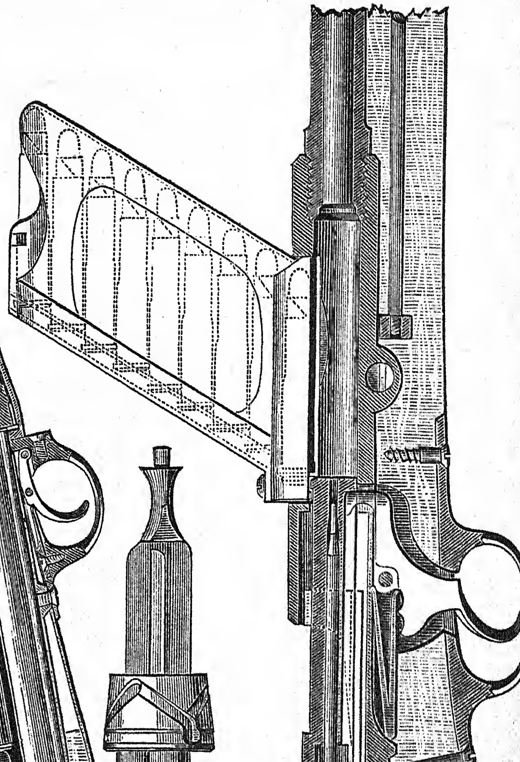


Fig. 150.—The Mannlicher Detachable Magazine Repeater.

powder, and the bullet weighs 360 grs.; or, for a sporting rifle, Eley's ordinary Express bullet may be substituted. The rifle is made in two lengths; the larger is 3 ft. 10 in. over all, weighs 9¼ lbs., with a 12-shot magazine. The carbine, or shorter model, is 3 ft. 6 in. over all, weighs 8¼ lbs., and has a 9-shot magazine.

A new Express model of 500 bore has also been introduced by the Winchester Arms Company. Its magazine contains 5 shots only; its length is 3 ft. 7 in. over all, weight 8¾ lbs. It is sighted up to 300 yards, and has a point-blank range of over 100 yards. The construction and mechanism is similar to the preceding models, and the cartridge is treated of with other sporting cartridges; and their latest model, 32 calibre, amongst rook and miniature rifles.

THE HOTCHKISS MAGAZINE GUN.

This rifle, manufactured by the Winchester Arms Company, has been adopted for use in the United States service. It is the invention of Mr. B. B. Hotchkiss, an American, and was first shown at the American Centennial Exhibition in 1876. We illustrate it in Fig. 148. It will be seen that it is upon the door-bolt principle. The magazine is in the butt, and will contain six U. S. Govt. regulation cartridges. The cartridges pass through the hollow trigger, and are forced before the breech-bolt by a spiral spring. The magazine may be cut off by a stop placed on the side of the arm; and by a modification, suggested by Lieutenant Russell of the United States Army, a detachable magazine containing four cartridges may be placed in the stock. There is a spiral mainspring and needle plunger. The extractor is affixed to the breech-bolt, as in the Winchester. In all there are twenty-six distinct parts in the magazine and breech mechanism, and its complexity, together with the spiral spring, are such serious drawbacks that we do not think it will ever be very successful as a military arm, and certainly cannot be considered the perfection of a magazine gun.

A gun very similar in mechanism has been adopted by the French Government for use in their Navy.

THE MANNLICHER SYSTEMS.

Both of these mechanisms (Figs. 149 and 150) are upon the door-bolt principle. The predominating novelty in the first pattern (Fig. 149) is the magazine. It consists of three joined tubes revolving in the stock; they are filled successively underneath the breech-action, in front of the trigger-guard; the cartridges are propelled towards the chamber by the usual spiral spring; when one tube has been emptied a ratchet movement brings another one into gear. The hand is necessarily large, as shown in section, the cartridges small, ·430 calibre, and the magazine is constructed to take eighteen. The other model takes the same cartridge, and the breech-mechanism is essentially the same. The magazine is detachable, and forms an ammunition pouch for eight or ten cartridges; it is affixed to shoe of breech-action in several positions, of which the one illustrated is the best. The cartridges fall into the breech by their own gravity, and are pushed home by the bolt. Report states that in the trials now proceeding at Enfield, for choice of a repeating arm, the Mannlicher system has failed.

THE MARLIN SYSTEM.

The Marlin Rifle, which is now on the market in two calibres—·320 and ·450, is an American invention, illustrated in Fig. 151.

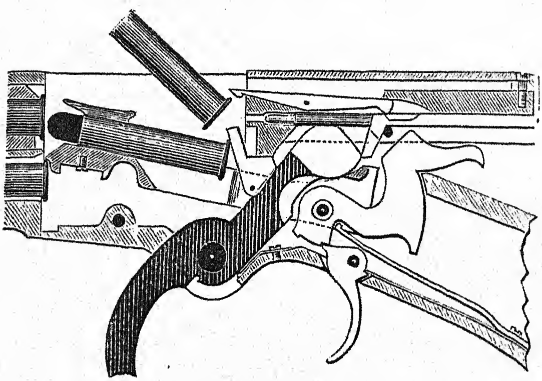


Fig. 151.—The Marlin Magazine Gun.

The mode of manipulation is similar to the Winchester; it differs in as much as the carrier is pivoted and the extracting mechanism stronger; besides which the movements are fewer, and the arm less complicated and capable of good execution with heavier charges than many under-lever magazine arms.

The Whitney Arms Company's Kennedy Rifle is very similar to the Marlin, save that the breech-bolt is solid and the under-lever travels very far to actuate such simple mechanism. Mr. A. Burgess, of Oswego, is a prolific inventor of fixings to magazine arms, and more than one arm owes its production to his genius. His own gun was unfavourably reported upon by the United States Commission in 1878; but he has a new model that promises well, and is shortly to be produced by the Colt Company.

THE SCHNEIDER SYSTEM.

This mechanism is based upon the falling block of the Sharp Rifle with a tubular magazine under the gun-barrel. When the breech-block is

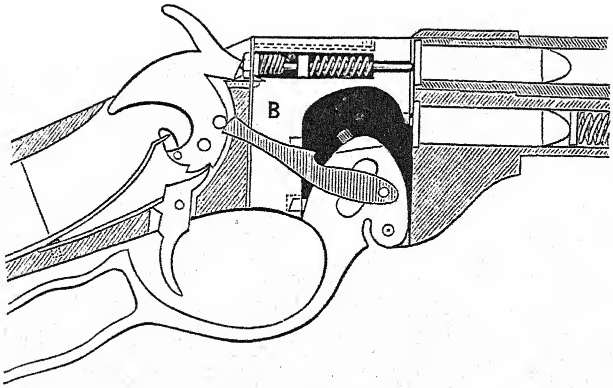


Fig. 152.—The Schneider Magazine Gun.

depressed by the lever the cartridge slides out of the magazine on to the top of the block, which is then raised by closing the lever, and a swinging cam on the left side of the breech-block carries the cartridge into the barrel

chamber. On again opening the gun this pivoted cam acts as an extractor to withdraw the fired case. The gun is cocked by a swivelled link between lever and breast of the hammer. This principle, known as the reciprocating block system, has the advantage of extreme simplicity, and is a good basis for a repeating arm.

THE SCHULHOF REPEATER.

This principle, the invention of Mr. J. Schulhof, of Vienna, possesses several novel points, the chief of which are a commodious and handy magazine, a powerful and effective cartridge carrier, and a unique trigger.

As will be seen from the illustration, the breech-action is of the common bolt form. The trigger is a raised catch on the top of the grip of the stock. The cartridges—any number up to twenty-eight—are carried in the stock, which has a large lid on the one side; a circular tube or cartridge-way leads from the magazine to the lifter immediately under the breech-bolt. In this tube works a transport rail extending the length of the tube, and linked to the breech-bolt. The action of the parts is as follows:—The magazine being filled, the breech-bolt is turned half over and withdrawn; this cocks the gun and pushes the transport rail to its furthest extent toward the heel of the stock; the cartridges—three or four, depending on number of compartments in the magazine—fall into the way, and spring teeth on the transport rail engage on the base of the cartridge-rims; on the breech-bolt being returned home, the rail with its load advances the length of the cartridge springs; stops projecting into the cartridge-way prevent any retrograde movement on the part of the cartridge; so that upon the block being again opened the spring teeth of the transport rail glide over the cartridges towards their base, and each time engage and hitch up fresh cartridges; thus at every movement each cartridge in the "way" is carried one step nearer the barrel chamber. When underneath the breech-block, the arm being open, a spring under the lifter raises it, and the cartridge is brought into a line with the barrel, to be pushed home by the lever.

Gear is added to disconnect magazine, to bolt the trigger, and to cover up breech-action. The salient points of this truly novel arm are the arrangement of the cartridges in the magazine, and the strong carrier—both so arranged that the cartridges cannot possibly come into contact with each

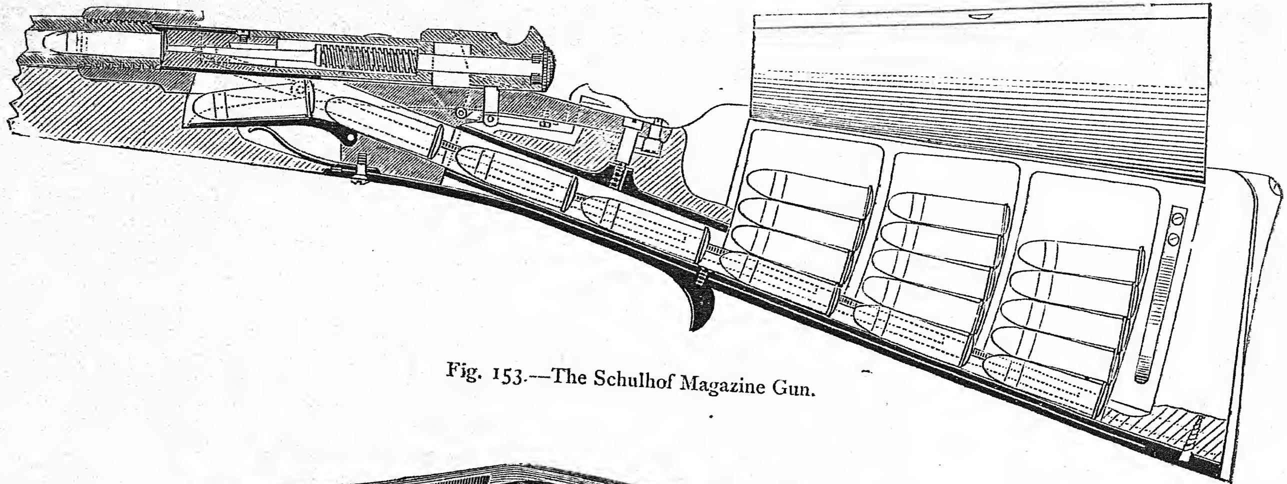


Fig. 153.—The Schulhof Magazine Gun.

Fig. 154.—The Needham Magazine Gun and Cartridge.

other; a simple automatic lifter; a strong extraction and ejection of the fired case; and an easy pull-off. An expert should be able to empty the magazine of twenty-five cartridges in less than thirty seconds, and have time to take a fair aim.

THE NEEDHAM MAGAZINE GUN.

This, the only English repeating rifle, is of novel construction; the idea, most happily conceived, combines the principles of the ejecting hammerless gun and the revolver with a tubular magazine gun.

The cartridges, which are of special design, are forced by a spiral spring, base first, into the chamber; to actuate the gun an under-lever is depressed and raised; linked to this lever are lifters engaging with a ratchet wheel upon a centre spindle to which chamber is keyed. The lowering of the lever carries the revolving chamber the fourth of a circle, partly raises the hammer by another ratchet, and allows it to fall, an arm from it striking the base of the fired case, and thus ejecting it from the chamber *forwards*. On bringing the lever back to the stock, the revolving chamber is carried round another fourth of the circle, bringing the loaded chamber in a line with the barrel, the empty chamber in a line with the tubular magazine, and cocking the arm.

The cartridge, shown separately, consists of two pieces, the base having no rim, and the sides tapering toward the base instead of from it; at the mouth a collared cap fits tightly the exterior of the cap, and projects some way into the interior of the case. The internal diameter of this collared cap is that of the bore of the rifle, and into this collar the bullet is fitted. The percussion cap—ordinary pattern—is in the base of the cartridge. When fired the collar is driven forward, and expanding prevents any escape of gas at the joint of the barrels and chamber, and being taper and short the cartridge never fails to be ejected. The powder in the cartridge case lies all around the bullet, as well as at the base; in fact, the bullet is embedded in the charge of powder. Experiments fail to detect any injury to the bullet or shooting by this arrangement, and all the powder is apparently burnt, and its full energy obtained.

The system is to be greatly commended. It is decidedly original, of

sound principle, and unlike any of the numerous magazine arms now flooding the market.

THE VETTERLIN REPEATING RIFLE.

The Vetterlin Repeating arm is named after its inventor, a Swiss who has made three separate models, the earliest in 1869, the second in 1871, and the last in 1874. We illustrate the last model in Fig. 155. It will be seen that the gun is loaded by drawing backward the sliding breech-block, similar in construction to that of the Chassepot and Needle

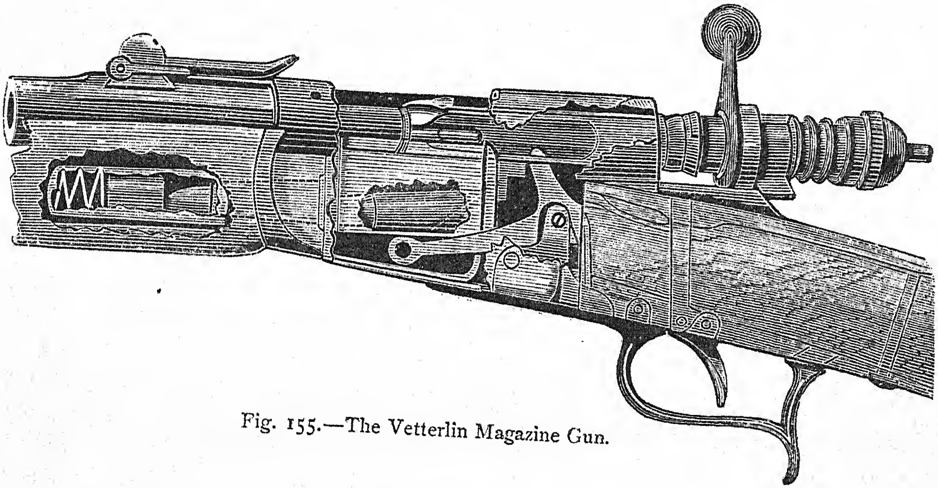


Fig. 155.—The Vetterlin Magazine Gun.

Gun; a stud upon the bolt presses against one arm of a bell crank lever; when the bolt is drawn backward, the other arm of the lever raises the cage containing the cartridge on a level with the chamber in the barrel, when the breech-block forces the cartridge, into the chamber, and the cage falls to a level with the magazine under the barrel, and receives another cartridge. The cartridges are inserted at the side of the arm, and the magazine cage and extractor are similar to that employed in the Winchester Rifle. The cap is exploded by means of a needle and spiral spring fixed in the breech-block.

On this principle, but with various slight and unimportant modifications, are the Repeating Remington, Sharp's Company, Ward-Burton, and Burton Rifles, tested by the United States Board of Ordnance officers in 1878.

To Mr. Morse, of Washington, D.C., is undoubtedly due the honour of first calling special attention to the merits of magazine arms, both in the United States and Europe; he also energetically worked for the issue of breech-loaders to troops. His merits as an inventor deserve much recognition, but his persistent claims to the various governments who have since made use of the information he gave, have been met with the usual treatment the true inventor receives from governments.

WEAPONS OF WAR.

Many volumes have been entirely devoted to an exposition of "weapons of war," to be followed possibly by many more; the Author therefore will but attempt a short *resumé* of guns past and present, and advance a few conjectures as to future arms.

In Europe alone there exist more than seven million stand of arms, each rifle amongst them capable of killing at 500 yards' distance, and will average at lowest computation twenty rounds each minute. Each country is provided with machine guns, giving an average of two hundred shots each minute, and with cannon having a range extending over eight miles. Yet in recent battles the percentage of belligerents slain has been less than at those in which fire-arms have been fired but once during the conflict, or indeed have not been fired at all. The perfecting of offensive weapons does not therefore necessitate an increased mortality in war, and even were it so the ethics of warlike destruction admit of it.

The style of small arm most generally favoured is the Remington. Numerous models but slightly differing have been issued, and the perfected weapon, in which many defects existing in the Egyptian and other earlier models, is here shown.

The breech-block is actuated by a neat side-lever, and is bolted up to its work by a lever independent of the hammer. The parts of the simple mechanism are all strong, and the extraction powerful. Its cheap-

ness is greatly in its favour, and as a single rifle for military purposes it can hardly be equalled.

The breech-action, though of vital importance in a military rifle, is not the greatest essential; there are several actions, as the "Field," the "Soper,' the "Sharp," which *cœteris paribus* might with advantage be used to military rifles.

Fig. 156.—The Perfected Remington Rifle.

Speed is a desideratum to a certain point. With the Henry rifling the friction is so great that with 30 rounds, at a rate of 40 per minute, the barrel becomes too hot to hold. To obviate this a more suitable rifling and ammunition must be sought, or two barrels must be used. Many writers well versed in the science of gunnery have advocated a double rifle. The oft-repeated prophecy that it will be the military arm of the future has yet to be proved, but the principle possesses many admirable points.

Our ideal military arm is that of a double rifle, the barrels one over the other, not side by side, the cartridges to be inserted in couples,

joined at the base as in the accompanying illustration, the chambers suitable also for single cartridges.

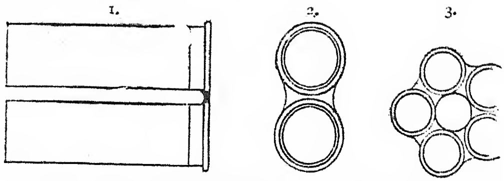


Fig. 157.—Rifle Cartridge Cases of the Future.

The idea of joining the cartridge cases at the base we believe to be original, and since the publication of the First Edition the Marres-Braendlin Mitrailleuse Pistol has been produced, taking cartridges arranged as for a revolver, sketched in No. 3.

The breech-action of this ideal arm should be on a falling block principle, as the "Field," Fig. 128; for such principle offers more advantages for a double arm than any of the swing, hinged, or bolt breech-blocks. The rifling will not be an accelerating spiral, nor the grooves deep, the desiderata of a rifle being greatest accuracy, range, and durability with the least recoil, fouling, and charge. The bore need not exceed ·410, or even ·400; the grooving should be shallow and slightly progressive—that is, deeper at the breech than at the muzzle end; of an equal spiral; firing a cylindro-conoidal bullet, patched or cannelured and of a diameter ·005 smaller than the bore of rifle.

The Regulation arm has a bore of ·450, a bullet of ·451, with paper wrapping ·459; the chamber is much larger than would be required for a solid drawn metal case, therefore the bullet expands in the chamber until it is some 12,000th of an inch larger in diameter than the barrel through which it has to pass. Naturally the bullet has to be compressed in passing through the barrel, and so there is great friction, heavy recoil, impaired accuracy, and much loss of power—all needless. Beyond 800 yards the Martini-Henry is not to be depended upon, and this year (1883) at Wimbledon it was not used at the 1,000 yards' range, the 800 yards' being fixed as the limit.

A shallow grooved rifling, a well-fitting bullet, a comparatively small

charge of powder and a ·410 bore, can be made to give accurate shooting at 1,000 yards, with little friction, no appreciable recoil, and less expense. Of the truth of this we are convinced.

Machine guns are destined to play an important part in future wars, and although superseding neither cannon or small arms, they form an important adjunct to both. They are of many systems and sizes, some

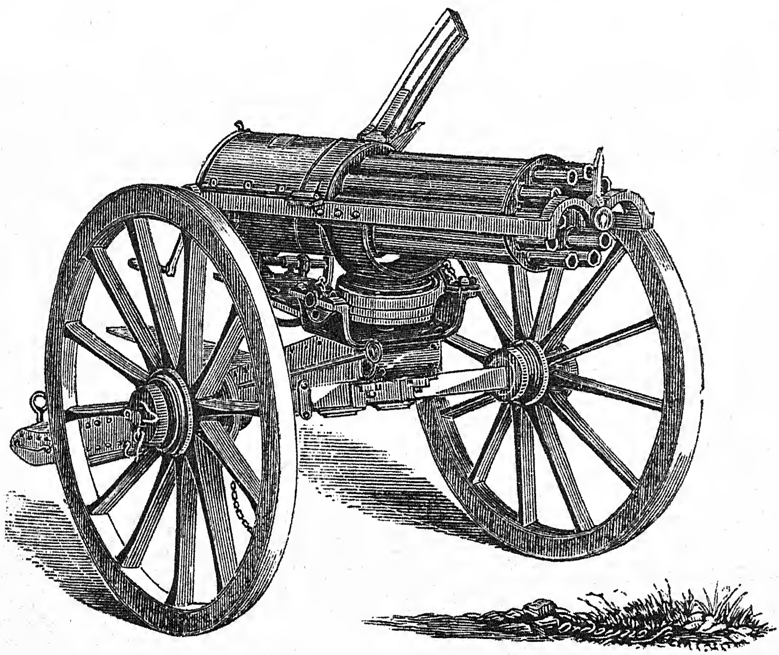


Fig. 158.—The Gatling Gun.

tried and so renowned that their names have become household words, others but existing in the imaginations of the patentees. Amongst the former are the Gatling and the Mitrailleuse; more recent productions are the Gardner, the Lowell, the Hotchkiss, the Nordenfeldt, and the McLean. Some of these are incomplete, and the Mitrailleuse is falling into disuse.

The Gatling and the Hotchkiss—both modifications of the same

principle—are the two only representatives of machine guns with revolving barrels admissible as effective weapons, but the principle of these has been superseded by the Nordenfelt-Palmcrantz Gun, which has been adopted as the standard machine gun by the English.

The Revolving Gun invented by Dr. Gatling, an American, and adopted by the United States and English Governments, is illustrated in Fig. 158.

There are ten barrels fastened together, revolving round an axis parallel to their bore. Each barrel has a separate lock, with spiral spring, and an exploding-pin.

The cartridges, which are solid brass-drawn, are placed in a hopper at the left side of the gun; as each barrel comes opposite the hopper a cartridge falls into a groove, and is gradually forced into the chamber by a plunger; when at the farthest distance from the hopper the barrel is discharged, the cartridge is then gradually withdrawn and falls to the ground.

The gun is worked by a crank handle, and is elevated and depressed in the usual manner; it can also be moved laterally, so as to sweep a line.

The Gatling Gun fires but one barrel at a time, but in quick succession, the speed depending upon the bore of the barrels and the capability of the gunner. About 350 shots in two minutes may be given as its outside performance.

The Hotchkiss is a modification of the Gatling, by an American gentleman, and has recently gone through an exhaustive series of trials with the "Nordenfelt," the production of two Swedish gentlemen (Mr. T. Nordenfelt and Mr. Palmcrantz, of Stockholm), the result being the adoption of the Nordenfelt for use in the navy, and probably also for field service.

This new machine gun is shown in Fig. 159. It was specially designed for the destruction of torpedo boats, but is equally applicable for land service against regular troops, and of great advantage in guerilla warfare. It will be seen from the illustration that there are four barrels laid side by side. The cartridges are contained in hoppers, having as many divisions as there are barrels. The hoppers are placed on the gun and secured by a catch, the bottom is then withdrawn, and the cartridges from the various divisions fall into the respective chambers as the gun is manipulated.

The whole of the firing and loading mechanism, which is exceedingly

simple, is arranged behind the cartridge-hopper, the whole being worked by a firing-handle, which is moved backward and forward by the gunner. One hand only is required to work the firing-handle, so that the other is at liberty to adjust the elevation and direction of the gun. The gun can thus be efficiently worked by one man, as the charging of the cartridge hoppers

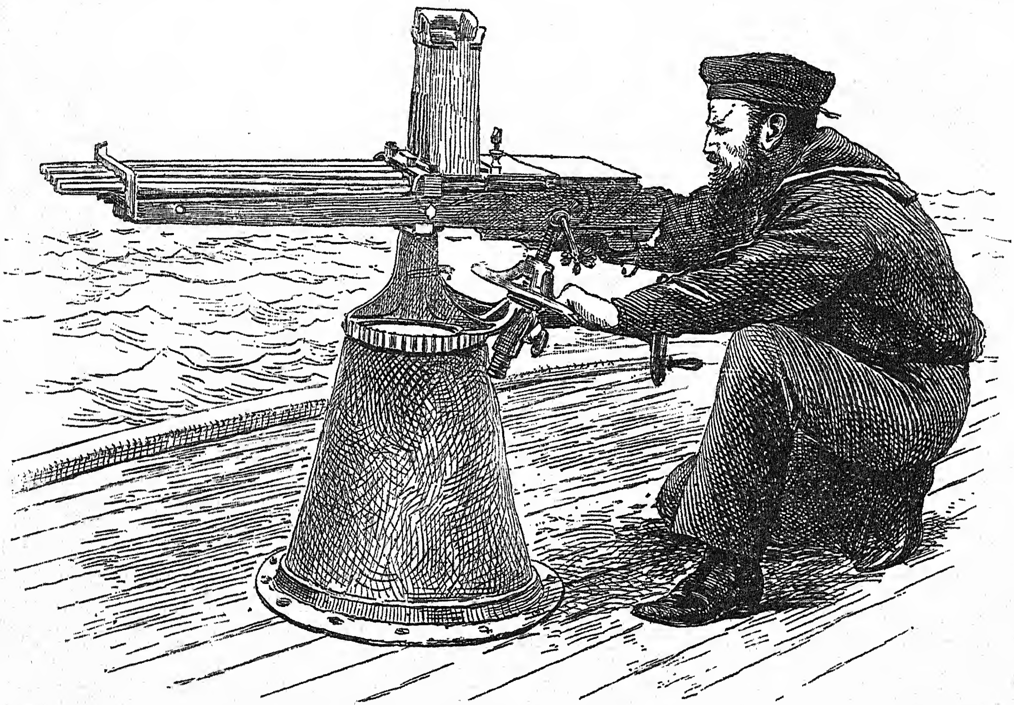


Fig. 159.—The Nordenfelt New Naval Machine Gun.

takes but a few seconds, whilst two men can work a gun continuously for hours.

The firing and loading mechanism is very simple, consisting of a piston and spiral spring to fire each barrel, and a breech-block. The trigger-comb arrangement is very ingenious, and is such that the barrels may be fired simultaneously or in quick succession, by adjusting a small screw. The entire mechanism can be removed and replaced in two minutes, or inspected

in a second. Should an extractor break or a barrel get injured, that barrel may be shut off and the remaining ones used, by simply altering the travel in the lever. In case of a gun having to be abandoned, it is only necessary to carry away the spiral springs or the cartridge-receiver (the work of five seconds), and the gun, without being injured, will be rendered useless. The gun has so many advantages over other machine guns that it would require almost a volume to enumerate them; suffice it to say that it is more expeditious, simple and cheap than any other machine gun, and that its success is undoubted by the best authorities.

It is made in various sizes for naval or field use, the number and size of the barrels being immaterial. It would be difficult to say the speed in firing that may be obtained, but its accuracy and speed has been proved sufficient to hit a torpedo boat, "end on," once in each second at 500 yards, and it has made more hits in a given time than other machine guns have fired shots. The cartridges are solid brass-drawn, firing a solid steel cylindro-conoidal projectile, covered or studded with gun-metal to take the rifling, which is 11-grooved, with a spiral of one turn in 60°.

The penetration is sufficient to pierce not only the torpedo boat, but also the boiler, or to damage the machinery so as to prevent the navigation of the boat; and the velocity is sufficient to fire charges of gunpowder enclosed in zinc, Clarkson, or flannel cases equally as well as ordinary machine guns with shells, whilst the range and the precision is infinitely better. The actual speed of a four-barrelled naval gun may be considered as 325 or 350 shots per minute. The barrels may be adjusted to fire together, to cross at a certain distance, or to sweep a line; and this, added to the advantage of being able to fire volleys in quick succession, makes it applicable for almost all kinds of warfare, and a formidable enemy to torpedo boats, and its adoption in all countries can only be the work of a few years.

Modern cannon are of a monster weight and calibre. Armour-plated ships and substantial earthworks have made them a necessity. Their shapely exteriors are more in accordance with scientific theories than the field-pieces and carronades of the first half of this century; and now that improved machinery has been devised to work them, they are far more easily manipulated than an old 56-pounder. The metal is at the breech, and each particle brought to bear a part of the strain of the explosion.

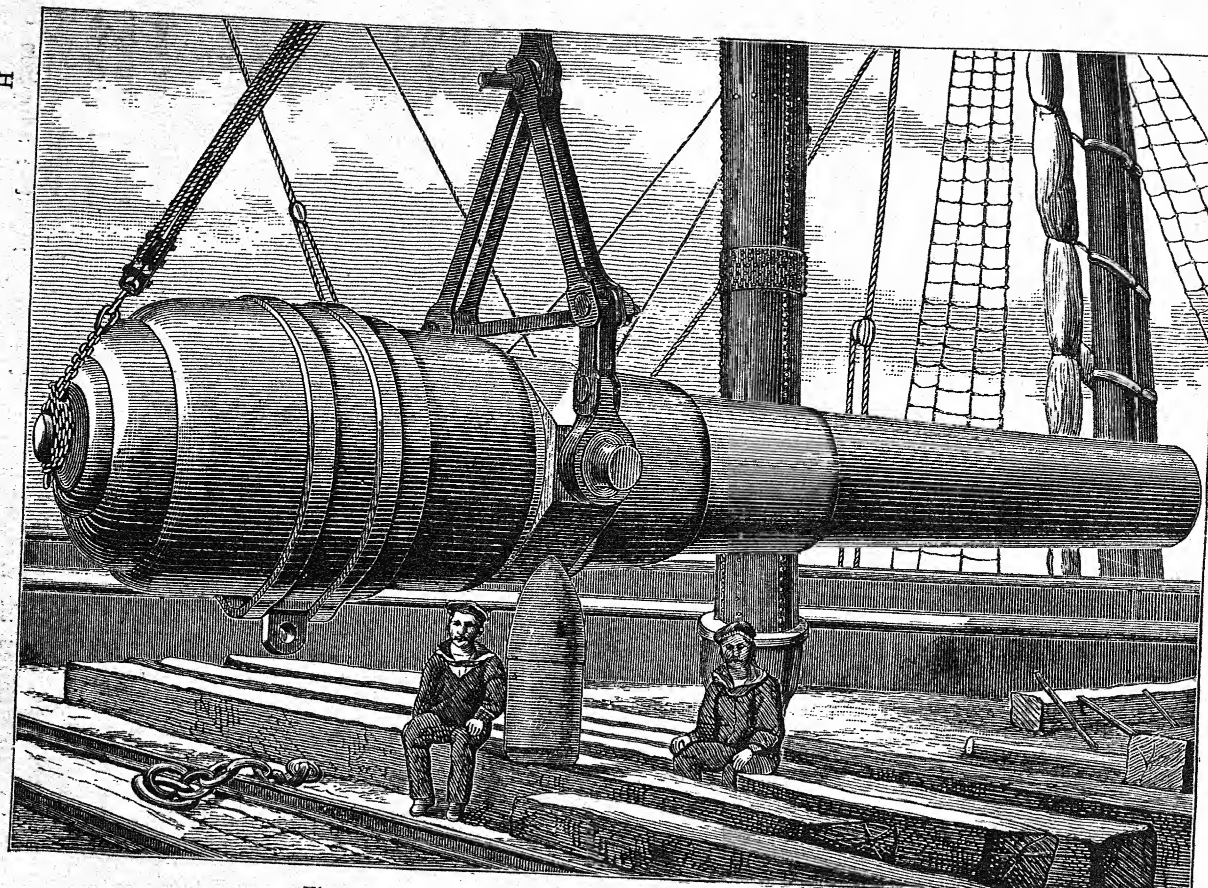


Fig. 159a.—The Armstrong 100-ton Gun slung for Transportation.

Sir William G. Armstrong, of Newcastle-on-Tyne, is far ahead of any Government in the manufacture of ordnance; the only existing rival factory is that of Herr Krupp at Essen.

From the principles involved in the construction of monster cannon—say those of 38, 45, 80, and 100 tons—the recoil and vibration are decreased, and the accuracy and range proportionately increased.

This is accomplished by making the guns of twisted wrought-iron coils, of great tensile strength, and arranged so as to resist the varied strains to which they are exposed. For instance, wrought-iron being nearly twice as strong in the direction of its fibre as it is crosswise, the Armstrong system adopts one disposition of fibre at one part of the gun, another where the strain is different in character. Thus, taking into consideration that the barrel may be burst or the breech be blown off by the explosion, the barrel is constructed of coils, whilst the breech-end is fortified against the longitudinal strain by a forged breech-piece, with the fibre running in a line with the bore.

The processes of manufacture are as follows:—

A solid-drawn steel tube is used as the foundation of the weapon, and around it is built the barrel of coils, the breech-piece being a solid forged mass of iron attached to the base of the tube, and also further strengthened by the coils.

The coils are made from "scelps," similar to ordinary sporting gun barrels, the scelps or bars being coiled round a mandril at a red heat, and welded together under a steam hammer. The coils are of different lengths and thicknesses, according to the position on the gun, no coil being made of thicker metal than can be perfectly welded. Each coil is bored out, and *shrunk* upon the steel tube, or other coil, as the case may be.

By having the exterior coils of thicker metal, and shrinking them on at a greater heat, they take part of the strain of the explosion, which is not the case with solid cast cannon, the outer portion of which sustains no strain whatever, all being borne by the first inch and a-half of metal.

The Armstrong system of twisted shrunk coils is doubtless as near perfection as possible, and bears a great resemblance to sporting gun barrels; and it only remains to improve the metal, dispense with the interior steel tube, and the system of manufacture will be perfect.

The modifications at Woolwich consist mainly in "the adoption of

inferior iron for the exterior, and the employment of a few long double or triple coils instead of several short single ones, and a forged breech-piece."

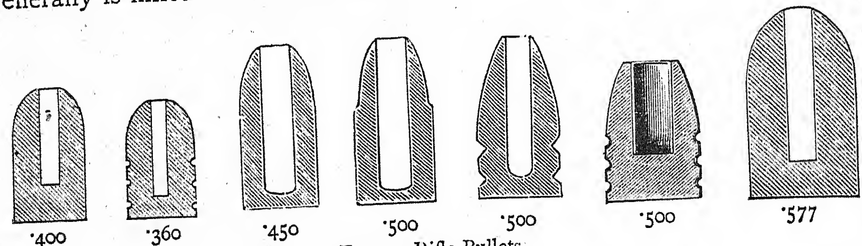
With respect to the range and velocity of modern cannon, the Armstrong 100-ton guns have given the best results as yet. When tried at Spezia in 1876 the great velocity and energy of the shot created much surprise, but the same gun after being chambered, *i.e.*, the interior of the steel tube enlarged at the base, gave even more wonderful results, viz:—A chilled steel projectile weighing 2,000 lbs. was fired with a charge of 463-lb., and attained a velocity of 1,627 feet per second, an energy at compact of 36·710 foot tons, with a pressure of only 20·8 tons to the square inch on the cannon. Monster cannon, on account of the great recoil, are rarely so mounted as to get more than 10° or 12° elevation, consequently the range compared with smaller cannon is inconsiderable. The following are the dimensions of the 100-ton gun shown in Fig. 159a.

Weight 100 tons, calibre 17 inches, length of powder chamber 52 inches, length of tube, 3,656 inches. The rifling is in equal grooves with an increasing spiral varying from 1 turn in 15° to 1 turn in 50 *calibres*. The Armstrong 6-inch Field Guns have a range of about 6,000 yards at 15° elevation. The longest range obtained has been with an 8-inch Armstrong Gun, which gave at 12° elevation the extraordinary range of 7,800 yards, and is available at a distance of eight miles. From these smaller guns the velocity of 2,070 feet per second has been obtained, and a 6-inch, carrying a 64-lb. projectile, will pierce the armour plates of ordinary ironclads under 2,000 yards range.

SPORTING RIFLES.

EXPRESS RIFLES.

The favourite rifle for sporting purposes at ordinary large game is an Express rifle of ·450, ·500, or ·577 bore. The Express principle is a large charge of powder, a light expansive bullet, slow spiral grooving, and great velocity; consequently a low trajectory and a long point-blank range are the result. The trouble of judging distances is in a great measure obviated, as the Express should shoot point-blank up to 160 yards, and game generally is killed at a less distance.



Express Rifle Bullets.

The rifling best adapted for all Express rifles is the square-grooved rifling with a slow spiral, 1 turn in 40 to 50 inches is sufficient. The size and weight must depend upon the strength of the sportsman and the kind of game sought, but in every case a double rifle should be taken if possible, especially in tiger, elephant, and bison shooting, where a second barrel, quickly following a misdirected or inefficient shot, will frequently save life, and always make the sportsman more confident and self-reliant. Conical bullets, with hollow points filled with wax, or copper tubes, are invariably used in Express rifles, and the relative sizes of the various gauges are shown.

The smallest ·360 is suitable for bustard, gazelle, and roe-deer shooting. The bullet weighs 150 grs., the powder 50 grs. Rifle weighs $6\frac{1}{2}$ lbs. if single; if double, $7\frac{3}{4}$ lbs. They are handy little weapons, with great smashing power, and are the *sine quâ non* for naturalists and collectors. The range is 250 yards; point-blank range 130 yards.

The ·400 Express is a hard-hitting weapon, and very effective for deer-stalking in general. The bullet weighs 180 grs.; powder 80 grs.

The gun, if single, $7\frac{1}{4}$ lbs.; if double, $8\frac{1}{2}$ lbs. It has a range of 250 yards, with a point-blank range of 160 yards; and for deer or kangaroo shooting, or general South American sport, it cannot be excelled.

The ·450 Express is an excellent all-round weapon; it is not too large for the Cervidæ, whilst it is equally effective among tapirs, seals and bears, and may even be successfully used at leopards, panthers, tigers and the larger carnivora. The bullet weighs 260 grs.; powder 120 grs. The gun, if single, from $7\frac{3}{4}$ to 9 lbs.; if double, $9\frac{1}{2}$ to $10\frac{1}{2}$ lbs. The effective range is 300 yards, and the point-blank range 150 yards.

The ·500 Express, of exactly $\frac{1}{2}$-inch bore, is considered by most Indian sportsmen the most effective all-round weapon for that country; it has great smashing power, good penetration, and it is not too cumbrous to cover moving game. The bullet weighs 300 grs.; the charge of powder is usually 135 grs. The range is about 300 yards, and the point-blank range 130 yards. The weight of a single rifle is from $8\frac{1}{2}$ to $9\frac{1}{2}$ lbs.; double 10 to 11 lbs. This rifle will stop a charging buffalo if well directed, and is serviceable at all the larger carnivora.

The ·577 is the largest Express rifle manufactured; it possesses great smashing power, and is particularly useful in boar-shooting, or amongst dangerous game. The bullet weighs 480 grs.; the charge of powder is 160 grs. Its effective range is a little over 220 yards, and its point-blank range about 120 yards.

The rifle, if single, weighs about $10\frac{1}{2}$ lbs.; if double, 11 to 13 lbs. The bullets for Express rifles being hollow, immediately flatten or expand upon meeting with a solid resistance; their penetration is consequently not so great, but their killing and paralysing power is far before a spherical bullet of the same diameter. The penetration is improved with bullets having hollow copper points or tubes, but these add slightly to the weight of the bullets given above.

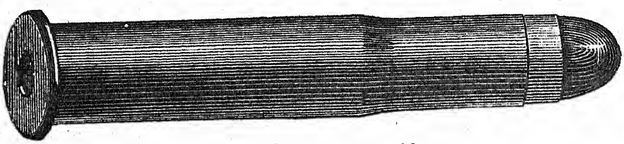
The weights of the bullets may be varied at will by having core plugs of various sizes fitted for use in the mould.

The recoil of the smaller Express rifles is reduced to a minimum: in the ·400 Express it is cognisable; in the ·450 and ·500 bores it is not at all uncomfortable; but with the ·577 it is heavy. The benefit of having a double rifle is again apparent, as the extra weight of the double barrel considerably modifies the recoil, without in any way affecting the safety

of the gun; and, taking recoil into consideration, we believe a double Express rifle can be made nearly equal in accuracy to a single Express rifle, providing the weights are in due proportion.

The "Magnum" Express differs from the simple Express in the cartridge, which is of greater capacity than those generally employed, and is loaded with heavier charges, and as light a bullet as compatible with accuracy. In some cases it is only the Express principle overdone, in others benefit results.

The "Magnum" charges are as follows:—the "Magnum" ·450, a bottle-necked case, 3¼ and 3½ inches long, powder 130 grains, bullet 260 grains. The "Magnum" ·500, a bottle-necked case of 3⅛ inches, powder 150 grains, bullet 340 grains. The "Magnum" ·577, considered the most



The No. 1 Express Cartridge.

powerful Express rifle made, bottle-necked case, 2⅝ inches long, powder 180 grains, bullet 480 grains. All these rifles have hollow or copper-pointed bullets.

The cartridges used in Express rifles are now invariably made of brass, solid-drawn, and are either taper or bottle-necked in shape. The ·360 Express is made on both models. The taper case is 2¼ in. long, and holds a charge of 30 grs.; the bottle-necked case is 2 in. long, and holds 40 grs. only. The ·400 Express cartridge is bottle-necked, being reduced from ·450 to ·400; it is 2⅝ in. long.

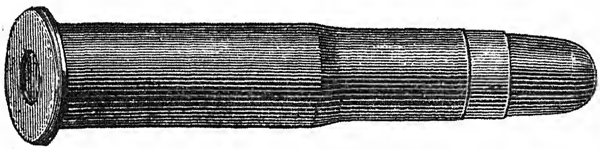
Of the cases made for the ·450 rifles, the one known as the No. 1 Express is the one for which we usually chamber our rifles; it is the best all round cartridge.

It will hold a charge of 120 grs., and is 2¾ in. long. The taper ·450 Express case is 3¼ in. long, and will hold a charge of 125 grs.

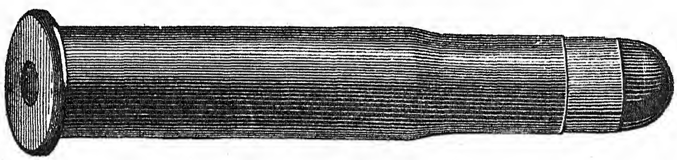
The No. 2 musket cartridge case, is also sometimes used to make a miniature Express rifle; it will contain 100 grs., and the bullet being

260 grs., an Express rifle is obtained with a good trajectory, and for deer-shooting it is especially suitable, as it will not smash so badly as the ·400 or ·450 real Express rifle, but its velocity and range is inferior.

For ·500-bore rifles there is the long taper 3-in. case, holding 140 grs. powder, and the bottle-necked No. 2 Express case, holding 130 grs.



The No. 2 Musket Cartridge.



The No. 2 Express Cartridge.

The Winchester Express Cartridge.

For the ·577 Express rifle one case only is made, the taper $2\frac{3}{4}$ in. case holding 160 grs.

There is also a ·425 hollow bullet made for use in the Winchester 44 repeating rifle; this bullet weighs 130 grs., and with 50 grs. powder makes an effective rifle for game-shooting at short ranges, but it is not so efficient as the English Express rifles.

A special Express rifle is also made by the Winchester Repeating Arms

Company, of ·500 bore; the bullet weighs 325 grs., and the charge of powder is 130 grs.; the cartridge, which we show, is slightly taper, and $1\frac{7}{8}$ in. long.

BREECH-ACTIONS FOR DOUBLE RIFLES.

Of the many actions used for double rifles, we believe there are none to equal our patent treble-wedge-fast action, with either hammerless or back-action locks and low hammers.

This action is fully described further on, and its strength and durability are unsurpassed. It is certainly much easier to manipulate than the double-grip action usually employed by the London gunmakers for their rifles.

The double-grip action, if well made, is, however, strong, and will stand a good deal of hard wear; on account of its simplicity it is cheaper to produce than the wedge-fast action, and although neither so strong or handy, we apply it to our cheaper grade of rifles, and by some sportsmen it is even preferred to any modification of the top-lever snap-actions.

In all cases back-work locks should be used, unless a hammerless gun is chosen. The back-work lock allows of more metal being left in the breech-action, and consequently the liability of the gun to gape at the breech is reduced.

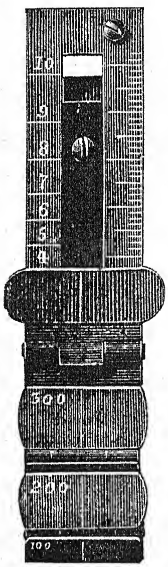
The hammerless system is particularly suitable for double rifles, and its excellence cannot fail to be appreciated by all practical sportsmen. We have already made several large and small Express rifles, also large bore elephant rifles, on this system, and all have been well approved of.

SIGHTS FOR SPORTING RIFLES.

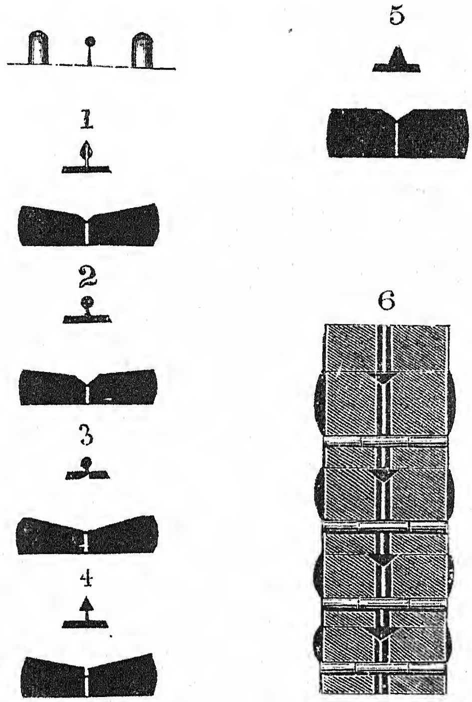
There are various forms of sights used in sporting rifles. We give an illustration of those most generally used.

No. 3 is considered the best for fine shooting. The V is broad, and extends the whole width of the leaf, having a platina line to mark the centre. Sometimes a small slot is preferred, as in No. 4. The muzzle-sights are put in lengthways, instead of across the rifle as formerly. No. 1, bead sight, is a good form for large-bore rifles; No. 3 is also adapted for

rough work, and not easily broken ; Nos. 2 and 4 are suitable for Express or target rifles ; No. 6 is a leaf sight roughed to prevent reflection. The muzzle-sights are frequently inlaid with platina for jungle shooting.



Cape Sight.



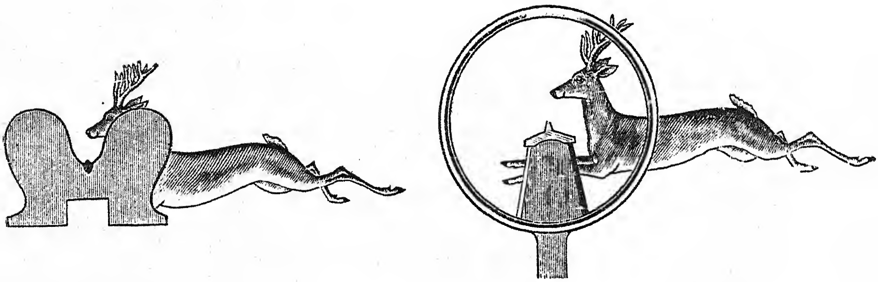
Sights for Sporting Rifles.

At the Cape a leaf and tangent sight combined is the favourite. With it the Dutch farmers will bring down antelope at 500 yards' distance, and gnu and buffalo at double that distance. It is unsuitable for Express rifles.

For shooting at running shots the American Lyman sight has been much recommended, and it is particularly applicable to single long-range Winchester and Rook rifles. For double rifles the open sights, with wide V, are preferable. The sight consists of an open globe on a screw stem fixed on the hand of the gun, as an orthoptic sight on a match rifle. It is

frequently used in conjunction with the beach combination foresight—a globe and pyramid sight pivoted in sight-block, and used either side up; but this is optional. The idea is to obtain a more clear and unobstructed view of the game and its surroundings than is possible with sights placed further from the eye of the shooter.

The two cuts illustrate the difference. The deep V of the Winchester



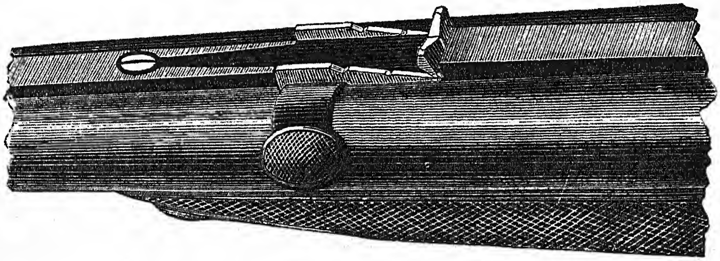
Running Deer, as seen with ordinary and "Lyman" Sights.

—the favourite in America, and excellent for fine shooting at a fixed mark—obstructs almost wholly a view of the deer, except for an instant, whereas with the Lyman the deer is always in full view, and correct aim may be taken without the hesitancy experienced when only a part of the mark aimed at is to be seen. Mr. Lincoln Jeffries used one of these sights at the London Rifle Trial of 1883, and speaks highly of it.

To elevate the sight when after game is seldom necessary with an Express rifle, as they possess a point-blank range sufficient for any distance at which the game ordinarily first presents itself. But with a spherical ball rifle, or the Winchester and other solid bullet rifles with high trajectories sometimes used for sporting purposes, to do so quickly is an advantage. The Winchester sight is a spring raised by a stepped wedge sliding along the centre of the top flat of the barrel, and adjustment is easily effected for large-bore rifles. The following is the better plan shown, produced by Mr. J. Rigby, of Dublin: it is an adjustable sight for sporting rifles, affixed to a double Express rifle. The sight consists of a steel spring screwed on to the top rib, with one end set at right angles and V-d to form

the sight; a rack travels along each side of the rib, and is moved by sliding the button on the barrel with the thumb. The rack is an inclined plane with notches, and by drawing it toward the breech the sight is elevated for two or three hundred yards' range.

The object of the sight is to raise the elevation for a long second shot without removing the gun from the shoulder. It is certainly ingenious, and can be easily and rapidly moved, but we fail to see its necessity with



Rigby's Adjustable Sight for Sporting Rifles.

Express rifles, and it is also open to the objection that a slight lateral motion cannot be prevented.

THE BEST KIND OF GROOVING FOR SPORTING RIFLES.

Gunmakers are much divided in opinion as to the best kind of grooving for sporting rifles, but the rifling we recommended in "Modern Breech-loaders" is now most in favour. For Express rifles the grooves should not be more than 5,000th deep, and with a slow spiral varying from one to one and a half in six feet. The number of grooves we usually adopt is 6, but it is not of great importance, 7 will answer nearly as well. The bullets do not strip, and the rifling is easy to clean, and the friction reduced to a minimum. It is shown in No. 1.

The Great (?) London Rifle Trial of 1883 has failed to prove to gunmakers the best kind of rifling adapted for Express or other rifles. The Henry, Lancaster, oval-bore, Rigby, ratchet, and rounded-grooved riflings were in no one case used, and we only surmise—but on very good grounds—that the Metford system was used. If we are right in our conclusion,

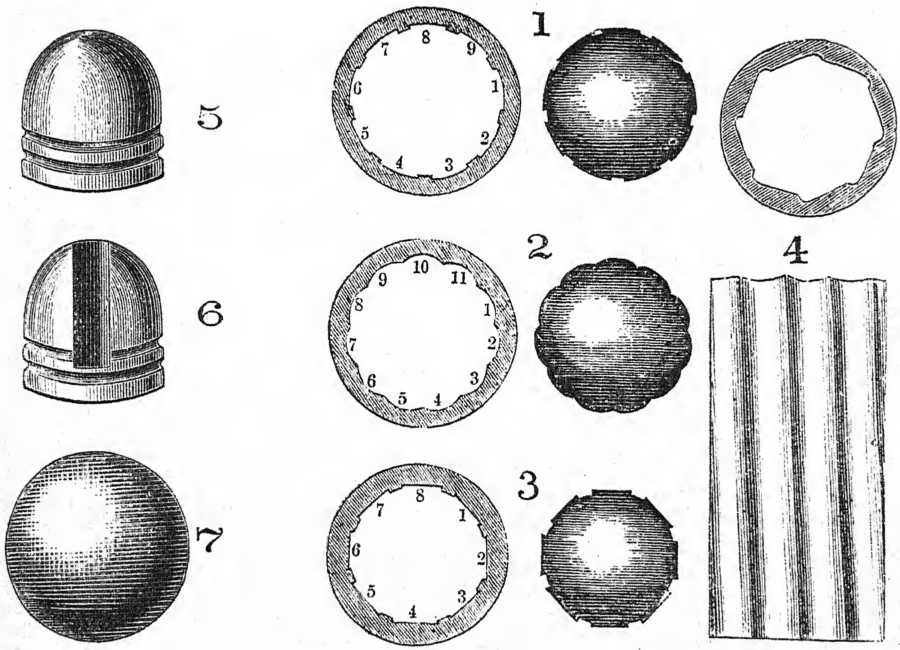
the rifle itself figured at the bottom of the competition. The winning rifles, Messrs. Holland states, "were all rifled on our new non-fouling principle." This may mean everything or it may mean nothing—more probably the latter. The non-fouling principle of Messrs. Holland, as generally understood, consists in having only the muzzle half of the barrel with grooves, the breech-end plain. This plan was originally designed for Rook rifles by, we believe, M. Pieper, of Liège. It is used in very small calibres with much success; but the difficulty of making an even and decided finish of the plain cylindrical barrel and the grooved part is against its perfectability. M. Pieper, in making the ·295 Morris aiming tubes on this principle overcomes the difficulty by making a rifle and plain half-barrel, and joining the two, a plan that cannot be followed with Express or heavy rifles. Messrs. Holland's Rook or miniature match rifle shot at the Trial may or may not have been rifled on this principle. Possibly it was; but we cannot think that the same principle was employed for their heavier rifles. The "non-fouling" therefore would mean simply that the grooves were shallow and broad, with rounded lands, so as to admit of the well-lubricated bullet and patch clearing out the fouling at each discharge. The examination of one of their rifles forces us to this conclusion, but it is advanced as conjecture only, based on a practical acquaintance with existing knowledge.

A smooth-bore rifle may be constructed in several different ways—with one open groove losing itself in the circumference of the barrel, one half of the barrel at any section being half an ellipsis, the other half a half-circle; secondly, by a two-grooved rifle, the grooves well opened and forming a perfect ellipsis; and further, by three or five grooves as open as the circumference of the barrel will allow. The oval-bore is a very old way of rifling barrels; and Captain Beaufoy, in "Scloppetaria," published in 1808, mentions it as well known before his day, and illustrates it and the tools necessary to produce it.

With a muzzle-loader, grooves, their shape and depth, were of much more importance than with a breech-loader. Now a bullet larger than the bore of the barrel at any point may be forced through it, and made to take the full effect of the grooves, whatever be their shape or depth. Shallow grooves are preferable, as easy to clean and altering but slightly the shape of the bullet. In a perfect rifle the grooves should be of the depth

of the thickness of the patch only (·008 inch), and then, the patch dropping off, a perfectly cylindrical bullet should be left for aerial flight.

The grooving already described as presumably used by Messrs. Holland is identical with No. 1, and described further in the first paragraph. In smaller bores fewer grooves are required, and the only difficulty is in cutting such wide grooves with so narrow lands to properly guide the tool.



Grooving of Sporting Rifles.

The rounded grooving shown in No. 2, is not now so much used, but for large poly-grooved rifles, in which the grooves are very shallow, it answers very well. This grooving we also show in section, and as will be seen the spiral is very slow, being only one turn in seven feet.

The ratchet rifling (No. 4) we do not consider nearly so good as either of the other forms, and it is now only used for the cheaper rifles.

No. 5 is a short, blunt, conical bullet, sometimes used in spherical ball rifles ; it increases the weight of the projectile considerably.

No. 6 is a hollow shell for the purpose of lightening the bullet, or may be filled with detonating powder, when it becomes an explosive shell.

No. 7 is the exact size of a 4-bore bullet, to fit into a No. 4 brass cartridge case.

Spherical ball rifles, except of the larger bores 8 and 6, have of late years been almost entirely superseded by the Express rifles.

In the smaller bores and at ordinary game they are neither so effective or handy as the Express rifles, and their trajectory and velocity is far inferior to the Express, but the penetration greater.

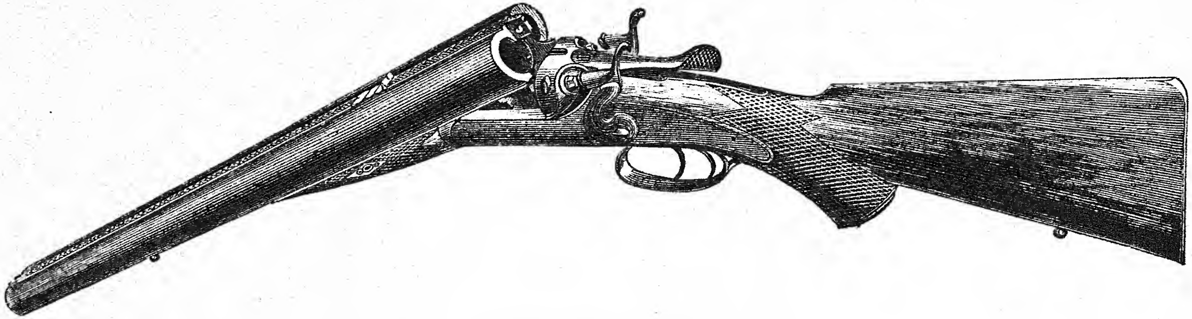
LARGE-BORE RIFLES FOR BIG-GAME SHOOTING.

Our close attention to this branch of the gun trade has gained our rifles a well-known reputation, and these arms may be styled one of our specialities. The question as to whether a large rifle is or is not a necessary adjunct to successful big-game shooting has long been disputed. Messrs. Sanderson, Carter, and other well-known Indian sportsmen are in favour of large rifles, and deem them indispensable.

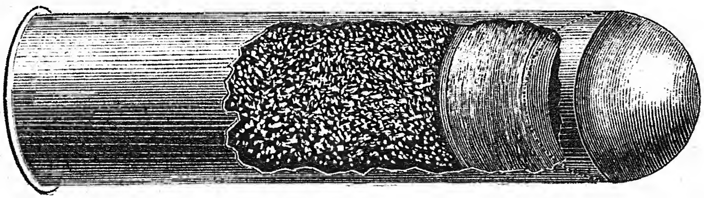
To slay so ponderous an animal as a full-grown elephant, a weapon is required that will give good penetration with great smashing and paralysing power. Express rifles are useless for elephant shooting, the bullets smashing up long before they reach a vital organ. The regulation Martini-Henry rifling would send a long-range picket clean through an elephant, but unless hit very luckily he would not drop, although the wound might in the end prove fatal. We have added further remarks on the large rifle question in the Shooting Notes on India and Africa, to which we must refer the reader.

The rifles themselves should invariably be double-barrelled, and the material and workmanship of the finest quality. We believe that the double 8-bore rifle, with the *brass* case and *specially rifled for the 2 oz. bullet*, will be found sufficiently large for ordinary large-game shooting.

Until we introduced these solid-drawn brass cases the 8-bore was only in reality a 9-bore, the bullet weighing 872 grains. The breech-action may be either our patent treble wedge-fast (with hammerless or with back-action



Double Elephant Rifle.



8-bore Brass Cartridge, for Elephant Rifles,

low hammer locks), or for cheaper rifles the double-grip breech-action. The former is much more handy and durable, or it may be made with back-action locks and low hammers, as shown in illustration, which represents a double 8-bore elephant rifle.

The weight of such a rifle with 24-inch barrels is about 16 lbs.; but they may be made as light as 13 lbs. This rifle takes a charge of 10 drachms with perfect ease to the shooter, and even 12 drachms if deemed necessary. Of course, this is with a brass case and spherical bullet, as shown.

These rifles are usually sighted to 200 yards, and have a point-blank range of about 100 yards, beyond which distance they are seldom used. A pistol-hand is invariably attached, to enable the rifle being more firmly gripped.

Double 4-bores are made on the same principle and with the same actions as the 8-bore described above. They, however, are usually bored perfectly cylindrical, and not rifled. They usually weigh from 19 to 21 lbs., and fire a charge of from 12 to 14 drachms and a bullet of 1,510 grains. With this charge the recoil is not excessive, a steady push only being felt. An Indian writer states that on a certain occasion one of these rifles with 12 drachms of powder went off both barrels together, and that he did not notice the recoil.

The penetration is excellent, and the paralysing power of the bullet crushing through the body will invariably drop an elephant, even when charging.

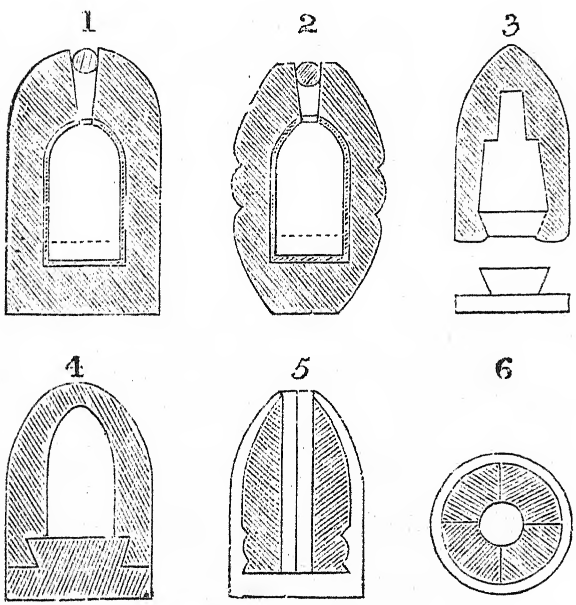
Often nothing but the immediate flooring of the elephant will save the life of the sportsman and his attendants, and nothing renders this more sure than the 4-bore rifle. An 8-bore will frequently fail to stop the charge, and for the few yards the animal staggers on, life may be lost and irremediable mischief caused.

To let a wounded elephant escape is very bad economy, and to be condemned almost as much as harassing and torturing the animal with innumerable small bullets, as some would-be expert sportsmen do. To kill the animal outright with as little pain as possible is the object of every true sportsman; and for elephant, bison, and other large pachydermata, nothing will effect it so well as the 8- and 4-bore rifles.

EXPLOSIVE SHELLS.

We give an engraving of Forsyth's swedge shell; also the copper-bottle shell.

The first shells invented contained a small charge of black powder which was ignited by an ordinary percussion cap placed on the point of the bullet, and which exploded on striking. The Jacob shell is an



Explosive Shells.

improvement, being a copper tube open at one end, containing both detonating and black powder. This shell is found to be rather uncertain in exploding, therefore Forsyth brought out the swedge shell as an improvement. This is cast in two segments, the detonating compound is then put in, the base of the bullet is joined to the other part, and passed through a screw swedge, which, if properly made, makes the bullet appear as one piece. These shells are only adapted for large-bore

rifles—16-, 12-, or 10-bores. The apparatus for making these shells is rather bulky and expensive, consisting of two pairs of moulds and one swedging machine.

Nos. 1 and 2 are the copper-bottle, No. 3 is the Forsyth, No. 4 figure represents the Forsyth swedge shell, Nos. 5 and 6 the new segmental shell. No. 5 is cast in a mould by means of a core-peg having four wings, which divides the mould into four chambers. The segments are then tied together, placed on a thin core-peg, put into a larger mould, and a thin jacket of lead cast round them, leaving a small hole at the point. The intention is that the bullet shall fly into pieces on striking, without the use of detonating powder.

The copper-bottle shell alluded to above is merely cast in a simple mould, first placing the copper-bottle inside, fixing it on a core-peg; this keeps it in the proper position to receive the lead. This peg is withdrawn, and leaves the opening to admit of the detonating powder being put in; the orifice is then closed with wax.

THE EXPLOSIVE COMPOUND FOR SHELLS.

The detonating powder used in shells is not easily exploded. The blow given to the shell on striking will explode it. It can be made, however, very sensitive, and requires care in mixing, which should be done as follows:—Take sulphuret of antimony and chlorate of potass, pounded separately, and mixed carefully in equal parts by weight with a bone knife, on a plate or some smooth surface.

THE STRIKING FORCE OF RIFLES.

Penetration is not always the great desideratum of a rifle; for when after large game, the rifle that will kill the quickest is the one required, and it generally possesses less penetrating power. The penetration of deal boards and the velocity of the bullet have generally been the basis of the various calculations respecting the striking force of rifles.

Probably no rifle possesses much greater penetration than the Government Regulation Martini-Henry, or greater velocity than the Express, whilst the 4-bore possesses the greatest amount of "striking force." We shall endeavour to show this by the following tables, the results of trials

with rifles before the Editor of the *Field.* The results given in the following tables were obtained from the ordinary gunmakers' table rest. The pine boards used were 1 inch thick, and 12 inches square. The distance 40 yards from butt of rifle to first board.

RESULTS.

MARTINI-HENRY RIFLE; ·450-bore; 85 grains Government powder No. 6; conical hardened bullet 480 grains; penetration 22½ 1-inch boards; velocity 1295 feet per second.

EXPRESS RIFLE; ·500-bore; 26-inch barrel; 9 lb. weight; 5 drams No. 6 powder; solid conical hardened bullet 381½ grains; penetration 27½ 1-inch boards; velocity not registered.

EXPRESS RIFLE; ·577-bore; 26-inch barrel; 10 lb. 2 oz.; 6 drams No. 6 powder; conical hardened solid bullet 502 grains weight; penetration 27½ 1-inch boards; velocity 1680 feet per second.

SPHERICAL BALL RIFLE; 12-bore; 26-inch double-barrelled; 11 lb. 12 ozs. in weight; charge 7 drams. No. 6 powder; hardened spherical bullet, 586½ grains; penetration 12 1-inch boards; velocity 1481 feet per second.

SPHERICAL BALL RIFLE; 10-bore; 26-inch double barrelled; weight 11 lb. 15 ozs; charge 8 drams of No. 6 powder; hardened spherical bullet; 689¼ grains; penetration 13¾ 1-inch boards; velocity 1460 feet per second.

SMOOTH-BORE GUN; 10 gauge; 28-inch double-barrelled; weight 11 lb.; charge 8 drams No. 6 powder; bullet 689¼ grains; penetration 16 boards; velocity 1470 feet per second.

ELEPHANT RIFLE; 8-bore; 24-inch; 13 lb. 8 ozs. in weight; charge 10 drams No. 6 powder; spherical hardened bullet 875 grains; penetration 19¼ 1-inch boards; velocity 1453 feet per second.

ELEPHANT RIFLE; 4-bore; 24-inch double-barrelled; weight 21 lbs.; charge 14 drams No. 6 powder; hardened spherical bullet 1257½ grains; penetration 19½ 1-inch boards; velocity 1300 feet per second.

[NOTE.—All the bullets were composed of 9 parts lead and 1 part tin, except the Martini bullet, which was 12 parts lead and 1 part tin; all were solid.]

EXPRESS RIFLE; ·500-bore; 26-inch barrels; weight 9 lb.; charge 4¼ drams No. 6 powder; with hollow-fronted hardened Express bullet and copper tube; weight 339 grains, length ·882 inch; penetration 11½ 1-inch boards; velocity not taken.

Remark.—Front of bullet opened out like a button mushroom to ·630 inch by ·725 inch.

EXPRESS RIFLE; ·577-bore; 26-inch barrel; weight 10 lb. 2 oz.; charge 6 drams No. 6 powder; hardened hollow-fronted Express bullet with copper tube; weight 458½ grains; length ·887 inch; penetration 13½ 1-inch boards; velocity not taken.

Remark.—Front of bullet opened to ·720 inch by ·867 inch, and curled back.

NOTE.—In these Express bullets the composition used was one part tin to 15 lead.

VELOCITY AND ENERGY OF BULLET ON IMPACT AT 105 FEET.

Size of Bore.	Charge of Powder.	Weight of Bullet.	Velocity of Bullet on Impact.	Energy or Striking Force of Bullet.
·450	85 grs.	480 grs.	1295 ft. per second	1797 foot pounds.
·500	4 drs.	381½ „	1610 „	2207 „
·577	6 „	502 „	1680 „	3163 „
12-bore	5 „	599¼ „	1270 „	2157 „
12-bore	6 „	599¼ „	1395 „	2603 „
12-bore	7 „	586½ „	1481 „	2871 „
10-bore	8 „	689¼ „	1460 „	3279 „
10 smooth	8 „	689¼ „	1470 „	3325 „
8-bore	10 „	875 „	1453 „	4523 „
4-bore	14 „	1257½ „	1500 „	6316 „

It will be noticed from these tables that the striking force of the 4-bore is far greater than that of the larger Express and spherical rifles.

When comparing the penetration it should be borne in mind that the larger the bore so much greater in proportion will be the resistance offered to the bullet. For instance, the 8-bore rifle bullet is three times the size of the ·577 bullet, and consequently has to overcome three times the resistance when penetrating the boards; *ergo*, although the 4-bore is only twice the diameter of the ·500 Express, it has to overcome four times as much resistance to penetrate the same number of boards, and this will doubtless account for the apparent disparity in the penetration upon a cursory examination of the tables.

THE VELOCITY OF RIFLE-BULLETS.

We have ourselves recently made a series of trials with various rifles, to determine the average muzzle velocities, and also the deviation in velocity of individual shots from the average velocity, having an idea that the extent of this deviation was greater than generally supposed.

In the results of the trials just given, the velocity recorded is that of an individual shot; so that, although of great use in comparing a given velocity with the penetration of pine-boards, it could hardly be deemed sufficiently thorough to form a basis for the relative velocities of various rifles; and the results were far from complete, inasmuch as the velocities of the hollow bullets from Express rifles are not recorded. We have endeavoured

to make the series complete by trying both large and small Express rifles. The spherical ball rifles we do not, however, consider require any further proof as to their velocity or striking force.

For these trials cartridges were specially loaded, each charge being carefully weighed, and bullets of a perfect shape and exact weight chosen.

The following are the results, and may, we think, be taken as the average performance of the guns in like weather, which was not at all favourable, the atmosphere being very thick and damp, and the barometer low. In summer, and with more favourable weather, doubtless higher velocities will result.

MUZZLE VELOCITIES IN FEET PER SECOND.

SIZE OF BORE.	CHARGE OF POWDER.	WEIGHT OF BULLET.	HIGHEST VELOCITY.	LOWEST VELOCITY.	AVERAGE VELOCITY.
·450–1	90 grs.	540 grs. *Solid.*	1,329	1,315	1,323
·450–2	85 ,,	480 ,, ,,	1,290	1,320	1,295
·450–3	75 ,,	480 ,, ,,	1,254	1,220	1.238
·450*	120 ,,	270 ,, *Hollow.*	1,725	1,718	1,722
·450*	130 ,,	270 ,, ,,	1,836	1,755	1,764
·450*	150 ,,	270 ,, ,,	1,928	1,832	1,913
·450*	130 ,,	310 ,, *Solid.*	1,863	1,804	1,812
·360*	50 ,,	150 ,, *Hollow.*	1,591	1,574	1,583
·380	16 ,,	120 ,, *Solid.*	977	959	965
·440	40 ,,	200 ,, *Flat-pointed.*	1,237	1,194	1,216
·500*	150 ,,	305 ,, *Hollow.*	1,827	1,755	1,766
·577*	150 ,,	480 ,, ,,	1.532	1,520	1,527
·577*	160 ,,	480 ,, ,,	1,595	1,565	1,579

1. Metford Match Rifling and Ammunition.
2. Government Rifling and Ammunition.
3. Henry Rifling and No. 2 Musket Cartridge.
* Express Rifling and Ammunition.

These results (except the ·380 and ·440 rifles) were obtained from the No. 6 rifle powder; we also tried a superior powder of the same-sized grain that gave higher and more uniform velocities. We are therefore inclined to the opinion that the powder-makers can, if they choose, produce a better powder for rifle-shooting than the brands usually sold. A great many opinions are current as to the relative velocities of Express, Long Range, Match, and Military rifles. The first two are usually exaggerated

considerably, and the Martini-Henry, with solid-drawn brass cartridges, was said to be wonderfully improved. We have tried it, and find no appreciable difference in the velocity. The velocity given for the Metford will doubtless astonish many, as some authorities have placed it much higher.

The ·577 Express can also be made to give a higher velocity by using a longer cartridge-case, and an extra drachm or 30 grains of powder. With 190 grains and the same weight bullet, a much more effective weapon is created, and even a slightly heavier charge may be safely used with comfort in a rifle weighing 13 lbs.

THE LONDON "FIELD" RIFLE TRIAL.

These trials were held at Putney the first week of October, 1883. The classes were for Rook rifles, double ·400, ·450, ·500, and ·577 Express rifles, and for double 12-, -8-, and -4-bore rifles. There were but six competitors —Messrs. Adams, Bland, Holland, Jeffries, Tranter and Watson. The rifles were tried for accuracy at one, two, and the Expresses at three ranges; the recoil, trajectory, and velocity of each winning rifle were taken.

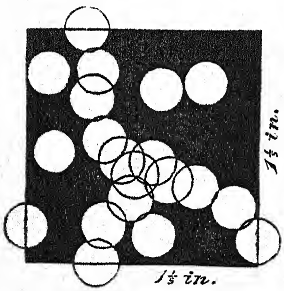
The trial resulted in Messrs. Holland being declared winners of every class; but to the gun trade, and to sportsmen in general, the trial cannot be considered to have been fully satisfactory, nor to have produced the conclusive proofs that were expected.

The best grooving or system of rifling has not been proved, the merits of rival systems still remain undecided. The terms "Express" and "point-blank" that so troubled the manager of these trials *have been* defined to his satisfaction, but the gun trade and public are now puzzled afresh as to what constitutes a Rook rifle. As Rook rifles, Messrs. Bland shot a ·380-bore, with 14 grs. of powder and solid bullet, a strong-shooting heavy rifle quite sufficient to drop roe or fallow deer and antelope; whilst Messrs. Holland used a ·295 miniature match rifle, 3 ozs. heavier than Messrs. Bland's, and fitted with platinum-edged, Vernier-marked, orthoptic back-sight and a globe foresight with wind-gauge attachment, the foresight afterwards opened with a file amidst the clamour of competitors.

In our opinion, and that of other gunmakers, this rifle was to all intents

and purposes a gallery-rifle, and, although technically within the conditions is not a weapon that would ever be taken out rook-shooting.

With respect to the accuracy of the various rifles shot, the trial produced no better diagrams than were expected, if so good. Messrs. Holland were lucky in the possession of an excellent shot and some good shooting-rifles; but there was nothing made at the trial that was not previously known to exist, and there are doubtless many rifle-makers who, before the trial and since, would guarantee the shooting of their rifles to equal the diagrams made. Indeed, we know as facts that some have built rifles, guaranteed, and obtained better diagrams than any ever published. There has been unwonted delay and reticence in making known the diagrams actually made at the trial. We are able to reproduce a few *fac similes.*



Holland ·295 Diagram, 20 Shots.

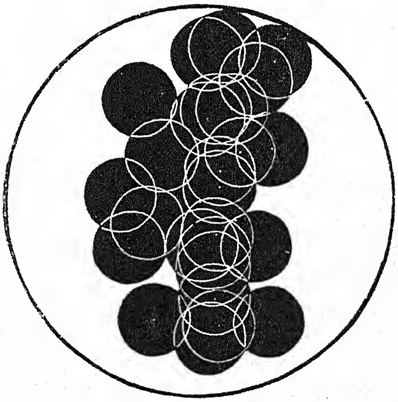


Diagram made with a ·350 Maynard Rifle, 30 Shots.

In the first-class Rook rifles the targets of Messrs. Holland were good, the one at 50 yards especially; there was a falling off at 75 yards, doubtless owing to the smallness of the charge of powder and lightness of the bullet. Contrast it with the Maynard target made with a ·350 bore American rifle, 30 consecutive shots at 50 yards with 30 grs. of powder and a naked bullet of 150 grs., rifle 7 lbs.

Taken as from a rifle of double the power, it is a much more remarkable performance. We need hardly say that it is properly authenticated.

The ·360-bore Express rifle is a difficult one from which to obtain very good shooting. Only one maker in Britain seems able to guarantee all shots in a 3-in. bull's-eye at 100 yards and all in a 5-in. at 200 yards; he did not enter for the Rifle Trials, neither was this calibre tried there.

The ·400-bore is a favourite small-bore Express; yet only one was

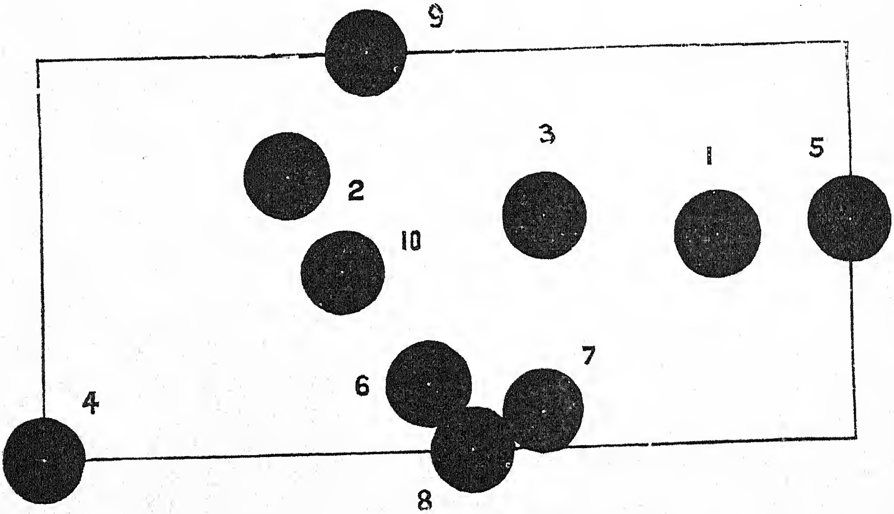


Diagram of ·450 bore at 50 yards.

tried, that of Messrs. Holland, and its accuracy, an average deviation of 1·139 at 50, 2·179 at 100, and 3·232 at 150, is not at all remarkable.

The ·450-bores did not shoot at all well; the best diagram was that by Messrs. Bland at 50 yards, a mean deviation of 1·032 inches. The diagram reproduced is that of Messrs. Holland's, the winning rifle, mean deviation 1·132, or in a square of 2·1 × 4·3 inches.

The same rifle at 100 yards put all in a 2·9 × 5·4 square, a mean deviation of 1·318 inches from centre of group.

The diagram made at 150 yards was nearly as good, all in a 3·9 × 4·9 square, with a mean deviation of 1·449 in.

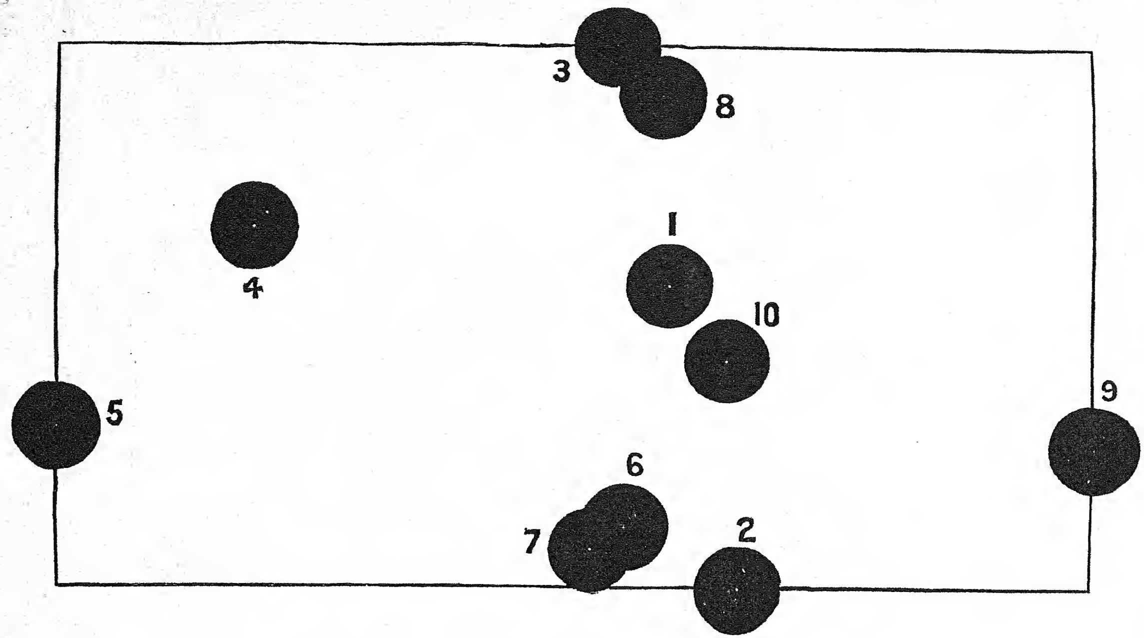
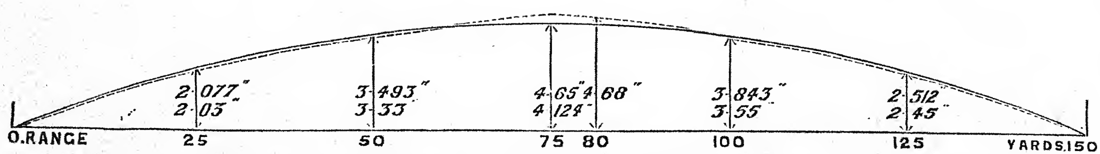


Diagram of Holland's ·450-bore at 100 yards.



Trajectory of Holland's ·450 Rifle as made at Rifle Trial. Curve by calculation; dotted line indicates flight as per screens.

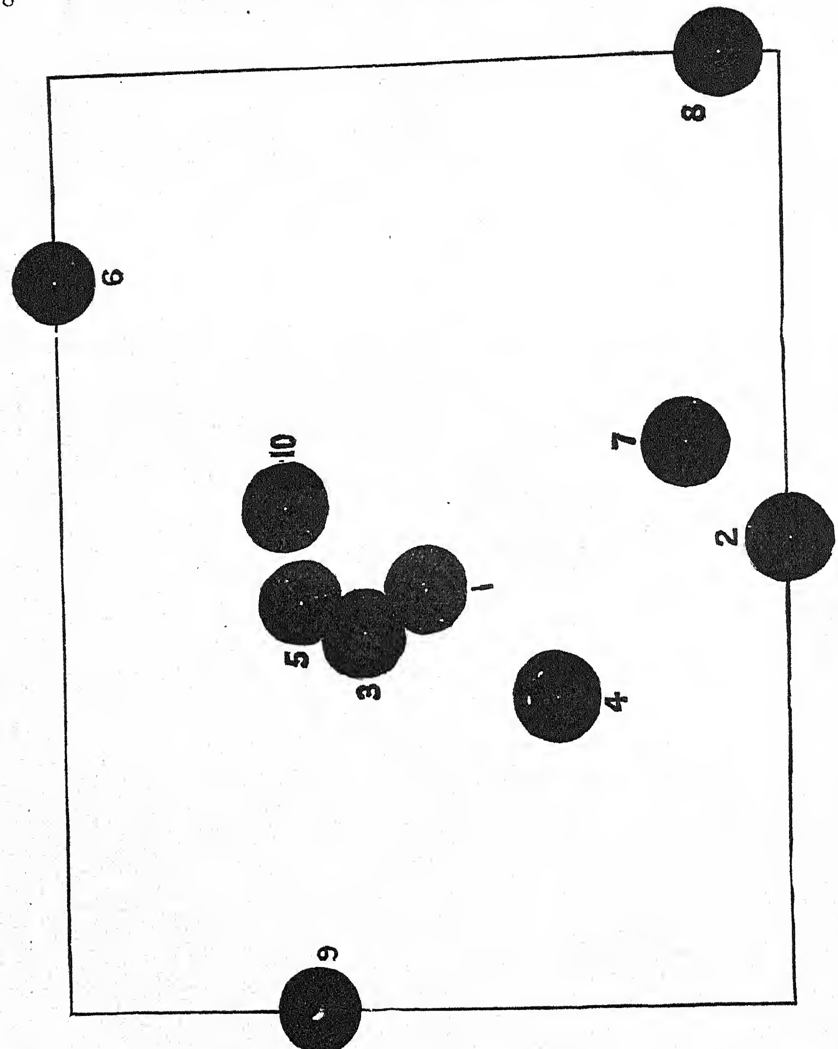


Diagram of ·450-bore a 150 yards.

The charge used was 110 grs., and a bullet of 322 grs., with patch and mercurial lubricant; weight of rifle, 8 lbs. 4 ozs.; recoil, 96 lbs.

The ·500-bore class was the better tried. Mr. Lincoln Jeffries, who

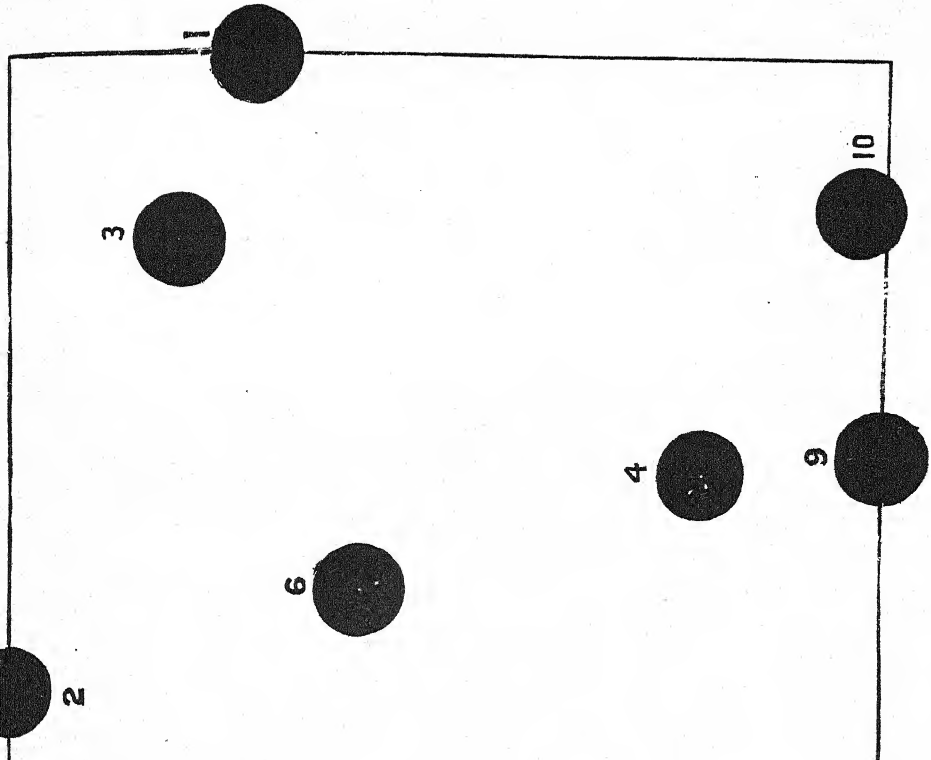


Diagram of 500-bore Rifle at 150 yards.

fired his rifles himself, was first at 50 and 100 yards, but fell off terribly at 150 yards, owing to a fault that rendered correct sighting impossible.

The mean deviation of his rifle at 50 yards was 1·052 in., at 100 yards only 1·004 in. but at 150 yards 4·124 in. At 50 yards all would have been in a square of 1·9 × 3·6, and of 2 × 2·8 at 100.

The best diagram at 150 yards, made by the rifle of Mr. Adams, is shown; mean deviation at 150 yards of 2·400, or the shots in a square 4·7 × 6.

The ·577 class was restricted to rifles, and 12 lbs.; the best diagram at 50 yards was made by Mr. Adams, with a 10 lb. 11 oz. rifle, mean deviation 1·056 in., or all in a square of 1·8 × 2·6, this with 164 grs. and bullet 507 grs.

Messrs. Holland, with same charge, but a bullet of 598 grs., had a mean deviation of 1·128 at 50 yards, but of 2·098 at 100, and 2·418 at 150, or in 4·8 × 6·3 and 4·8 × 7·7 respectively, coming out first in the aggregate owing to their better shooting and heavier bullet.

The trials of large-bore rifles were made at Nunhead. The shooting of Messrs. Holland's 13½ lb. 12-bore rifle, which was only fired at 50 yards, as were all other large bores, was indeed mediocre. With 7 drs. of powder, the recoil was 141 lbs. and the mean deviation ·993 in., but it surpassed that of its one competitor by several points.

The 10-bore shot weighed but 12 and 12½ lbs. respectively, and with 8 drs. 5 grs. and 8 drs. made mean deviations of 1·092 and 1·843 respectively, with a recoil of 163 lbs.

The 8-bore of Messrs. Holland, weighing 17 lbs. 8 ozs., and fired with 10 drs.—a very light charge for this calibre, some of the more renowned elephant-hunters using as much as 12 and 14 drs. in this bore. The mean deviation was 1·452 at 50 yards, or all in a square of 4·2 × 5·0. The recoil was 185 lbs.

The 4-bore, weighing 23½ lbs., and fired with 12 drs. only (full charge 16 drs.) made a higher recoil than 200 lbs., so could not be registered, and made a better diagram than the 8-bore, the mean deviation being only ·782 in.

A 12-bore smooth-bore ball-gun of Messrs. Holland's was then fired, but the diagram is so outrageously wide that we cannot think of publishing it as a standard. A smooth-bore shot-gun, choked or cylinder, should make a better diagram in good hands.

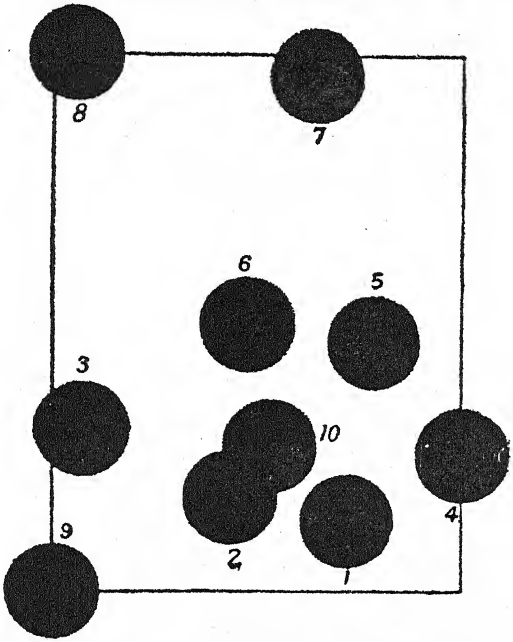


Diagram of Lincoln Jeffries' ·500 Rifle at 100 yards.

The following table gives the trajectories and velocities of the better shooting Express Rifles :—

Maker.	Bore.	Muzzle Velocity.	Average Trajectory at 25 yards.	50 yards.	75 yards.	80 yards.	100 yds.	120 yds.
Holland	·400	1873·6	1·77	3·12	4·35	4·45	3·28	2.28
"	·450	1776·	2·03	3·33	4·65	4·68	3·55	2·45
"	·500	1784	2·12	3·43	4·72	4·82	3·63	2·47
Jeffries	·500	1946	1·79	3·01	3·58	—	3·36	2·23
Holland	·577	1663·4	1·92	3·44	4·84	4·84	3·72	2·68

The velocities should be compared with those at other trials, given on pp. 212-13, with the exception of Mr. Lincoln Jeffries' ·500 bore rifle; they are but little, if any, higher. The velocity of the ·450 oval-bore Express Mr. Lancaster gives us as 1,426 feet, but with full charge it ought to be much higher, unless a heavier bullet than usual is employed.

EXPERIMENTS WITH EXPLOSIVE SHELLS.

Shells for large-bore rifles, such as the "copper-bottle" and Forsyth swedge shell, have been thoroughly tried on every kind of large game, and their utility in instantly stopping an animal is well known.

The effect of an explosive shell on an animal is much more paralysing than a wound from a solid bullet.

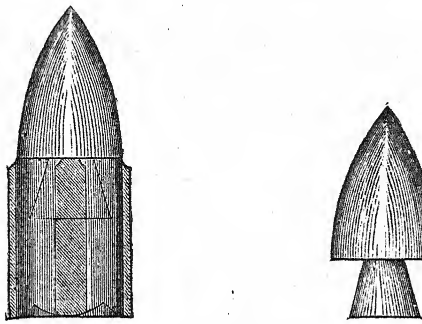
There is an impression among sportsmen that a small quantity of detonating compound, such as is used in the Forsyth shell, would not answer in small-bore shells. To satisfy ourselves on this point, we loaded an ordinary Express bullet by filling up the hollow with the explosive compound and closing the point with wax, firing it with a charge of 3 drams of powder into the head of a bullock. The bullet penetrated the skull and entered the brain, and on examination there appeared merely a small hole in the forehead; but on opening the head we found the brain completely destroyed; the shell had burst into small pieces, fracturing the bones. We then tried a ·450 Express bullet, weighing 300 grains, in the same manner. The hole in this bullet, being smaller, did not contain so much detonating powder, but the results were about the same, with the exception of the penetration; this was greater in consequence of the increased charge, which was 4 drams. The shell exploded more at the back of the head, completely shattering it. The rifle was fired at a distance of 15 and 40 yards respectively with the same results.

Our next experiment with these explosive shells was at a 3-inch walnut plank. The Snider shell entered by a small hole, and increased in size considerably to the depth of 2 inches, when it exploded, ripping up the far side of the plank. We also tried both the Snider and 450-gauge shells at a bag of damp sawdust. We found all the shells had exploded after passing nearly through.

We have proved satisfactorily that an ordinary conical bullet, having a deep hollow similar to an Express, is quite as effective as the copper-bottle or the Forsyth swedge shell loaded with the same compound, which is sulphuret of antimony and chlorate of potass in equal parts. It can be used in any size bore from 450 to 8. Light, short, conical shells can be used in shot-guns at close quarters with advantage. This shell bullet can easily be reduced to the weight of a solid spherical by increasing the size of the hollow.

SPECIAL BULLETS AND PROJECTILES.

Several attempts have been made from time to time to introduce some projectile that shall be more effective for large game shooting than the ordinary leaden bullet, and for the better penetration of the pachydermata a zinc or iron-pointed bullet has been tried. General Jacob was the great advocate for its adoption. We show his bullet with point, and also show the steel point separate. The bullet was made by placing the point at the bottom of the mould, and casting the remainder of the bullet in the usual way. The great drawback to the bullet was the imperfect junction



Iron Pointed Bullet and Point Detached.

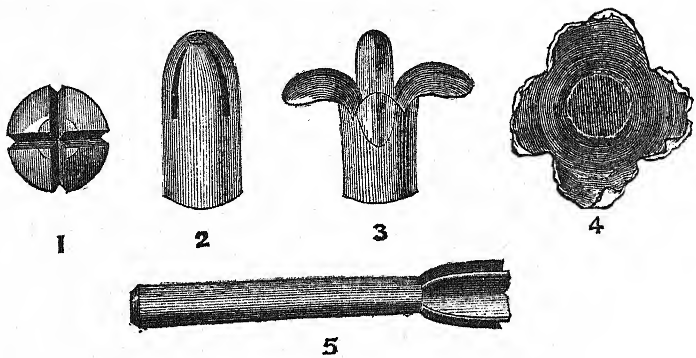
of the lead and steel, so that when it struck against a tough surface the lead stripped off and the iron point alone penetrated. A much better plan is to make the bullets of type-metal, and this in our opinion is the best composition of which to make them. Chilled shot makes excellent hardened bullets, but it is too expensive to come into general use. The best way of hardening bullets is to use mercury, 9 parts of lead to 1 part of mercury. Only sufficient metal should be melted to cast 9 bullets, the mercury or quicksilver then added, and the bullets immediately cast, as the mercury volatilises rapidly; hardened bullets are also made by the admixture of lead and tin. The best proportions are 1 part tin to 9 of lead, 1 part to 12 of lead, or 1 to 15 of lead; the latter is used for long-range bullets.

The smashing power of the Express bullet, combined with a good deal of the penetration of the solid bullet, is obtained from Lord Keanes'

cruciform expanding bullet. We show the bullet and core-plug required in casting it, and to be fully effective it should be made of hardened metal.

The bullet is cast with the upper half slit or divided into four equal sections, as in No. 1. It is then placed in a swedge, and the sections brought as close to each other as possible, as shewn in No. 2.

The bullet when passing through an animal opens out as in No. 3, and the real appearance of the bullet is shown in No. 4, which represents a



Lord Keanes' Cruciform Expanding Bullet.

bullet after being fired into a tub of clay. No. 5 is the core-plug required to form the bullet, with slits or transverse cuts. The advantages of this bullet are that it makes a small hole only in passing through the skin, but afterwards flattens out even more effectually than the ordinary Express bullet, whilst it does not flatten *outside* the skin, as is sometimes the case with soft Express bullets, and makes a more deadly wound than the solid Express bullet.

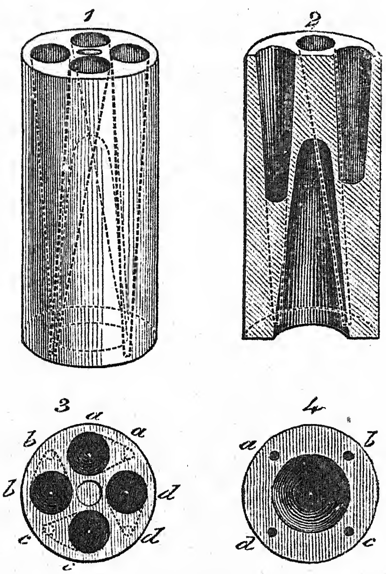
The moulds and swedging apparatus are rather expensive to manufacture, and this perhaps has prevented the bullet from coming into more general use. In America bullets are also made on this plan from lead rope, and slit by machinery.

An Express bullet, less liable to fall to pieces, and possessed of greater penetration than the ordinary hollow or copper-pointed bullet, has instead,

a pointed solid brass plug in the core, which, on contact with the flesh or bone of the animal, expands the bullet.

For use in cylinder-bored guns several projectiles have been produced which will, it is asserted, revolve by the resistance offered by the atmosphere during the flight of the projectile through the air. Some have projecting wings wound spirally round the bullet, whilst the best, known as Dr. Macleod's bullet, is pierced with holes, as illustrated.

The holes are tapered, and pierce the bullet longitudinally in a spiral direction ; they are four in number, about $\frac{3}{16}$ths in diameter at the point,



Macleod's Revolving Bullet.

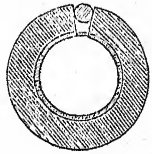
and $\frac{1}{32}$nd at the base of the bullet ; the exact sizes are given in the four diagrams herewith.

No. 1 is a longitudinal view of the bullet, and shows direction of the perforations. No. 2 is a section showing the hollow base. No. 3 is an end elevation of the point, and No 4 of the base ; the letters in both diagrams correspond.

This bullet has many disadvantages, and is positively dangerous to use

in a light double gun. The bullet for a 12-bore weighs $3\frac{1}{4}$ ozs., and is $1\frac{1}{2}$ inches long. Such a bullet could not be fired with ease from any gun lighter than $8\frac{1}{2}$ lbs., and to somewhat lessen the excessive recoil an india-rubber wad half an inch in thickness is employed. The shape of the projectile is against its cleaving the atmosphere cleanly, and even were its weight and shape altered in accordance with the laws of mechanics, we believe that the force required to enable it to revolve by the resistance it has to overcome can only be obtained by sacrificing velocity, and that therefore the bullet is no better than the ordinary spherical one.

In direct opposition to the above is the "Mead" shell, which we now illustrate. It consists of simply a hollow spherical core being cast in with the ordinary spherical bullet; it may be filled with detonating powder if deemed advisable.


The Mead Shell.

A large charge of powder may be used with this shell, and a higher velocity and greater point-blank range thereby obtained. On account of the lightness of this shell it is well adapted for use in shot-guns, especially choke-bores.

The shooting of all spherical ball-guns and rifles we find considerably improved by the use of the "Vector" wad. This wad is simply an ordinary pink-edge wad with a hole punched through its centre. The hole must be of such a diameter as to allow of the bullet bearing on the wad beneath the "Vector," whilst the bullet must bed firmly on the wad itself as well as on the wad beneath it. This wad, the invention of one of our customers, was especially designed and named by him for use in choke-bore guns. As the bullet must be smaller than the bore except just at the muzzle, the wad guides it down the barrel, and keeps it in the centre until it comes into contact with the choke. When the wad is used, a thin felt or pink-edge wad only is necessary over the powder, so that a larger charge of powder may be got into the cartridge-case if necessary.

BALL-GUNS.

Choke-bores may be used as ball-guns providing the bullet fired passes easily through the muzzle. The charge best suited for a 12-bore is from $2\frac{1}{2}$ to 3 drachms. If a bullet as large as can be placed in the cartridge-

case is employed, or one that will not easily pass the muzzle of the gun, it will result in the barrel being turned into a cylinder if the barrel is of first-class material; if only second-rate, the bullet will carry away the muzzle. Proper ball-guns should be nearly 11-bore, so that the bullet may fit quite tight in the 12-bore cartridge-case, and no turning down is then required. These guns, if properly bored and slightly contracted towards the muzzle, will make a pattern of 150 or 160 with No. 6 shot, and shoot ball with accuracy to fifty or sixty yards.

RIFLE AND SHOT-GUNS.

The combination of a rifle and shot-gun in one double-barrel weapon is much esteemed by South African sportsmen. The rifle barrel, usually the left, may be rifled on any system. Henry rifling is still most in favour at the Cape, and may be of ·450 or ·500 bore; the proper proportions of the two being ·450 rifle-barrel and 16-bore shot-barrel, or ·500 rifle-barrel and 12-bore shot-barrel. These arms are only useful in countries where the kind of game that may be met with cannot be determined beforehand, or for emigrants who cannot afford more than one gun. They have many drawbacks. The weapon is too heavy as a shot-gun, and makes flying shots almost an impossibility. The balance, of course, is bad. As a rifle the weapon is too light, and the recoil with some of the heavier loaded cartridges is considerable.

The heavy rifle-barrel not giving way in the least, causes the shot-barrel to become the more easily dented and damaged; a fall to a rifle and shot-gun generally finishes most disastrously for the shot-barrel. The rifle may be chambered for either of the Express cartridges or the long-range No. 2 musket-case; the last-named is most in favour in the Cape Colonies. The Government regulation ammunition may also be employed, but we do not recommend it.

In all cases where practicable, a single rifle and a double shot-gun are far preferable to the rifle and shot-gun; and we think the latter will eventually die out, and probably at no very distant date.

SPORTING SHOT GUNS.

THE EARLY PERCUSSION BREECH-LOADING ACTIONS.

IT is now some years since the breech-loading system firmly established itself in this country as a sporting or military weapon. Although the English are unable to claim the invention of this system, it is through their energy and untiring industry that it has achieved such magnificent results, and been brought to its present state of perfection.

The invention when first introduced was in a very crude form. We give in Fig. 160 an illustration of the original Lefaucheux Breech-loader, which may be termed the first successful breech-loader on the drop-down system; although, so to speak, a practically useful weapon when first introduced, the action was weak and imperfectly developed, but the great achievement was the introduction of a shell or cartridge case which should fit the breech of the gun. The shell or case, by expanding at the moment of discharge, effectually closes the breech-joint, and prevents the escape of gas. The escape of gas was the great difficulty to be overcome, and, however close the breech might be fitted, the gas would, without the case, escape at the moment of firing, and find a way through the joints of the best-fitting breech; its doing so was owing to the expansion of the metal. The happy idea of making the cartridge to contain its own ignition mainly contributed to the success of the invention. Strictly speaking, the cartridge case is the breech and nipple of the gun, the cap being inside the barrel; the brass striking-pin becomes the nipple, thus the objection to conducting the flash from the outside to the inside of the barrel is overcome. The advantage gained by this is very considerable, as it does away with the escape of gas which takes place in a muzzle-loader through the nipple-hole.

The pin cartridge case has been greatly improved upon by the rim-fire and central-fire principles, but these are only modifications of Lefaucheux's plan. (Invented in 1836.)

The great weakness in this breech-loading arm was the method of fastening the barrels to the stock or breech-action. By referring to the accompanying engraving (Fig. 160) it will be seen that the breech-end is raised for loading. This is the most convenient and handy arrangement for double-barrel breech-loaders. Many other plans have been tried and abandoned. The "drop-down" system, as it is called, has many advantages: one is, that the barrels drop of themselves immediately they are disengaged by the lever; the hinge-pin effectually prevents the barrel from moving forward when secured in position for firing; the standing-

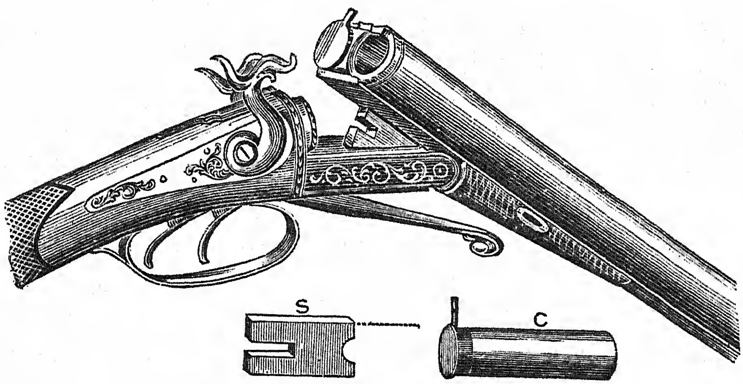


Fig. 160.—Lefaucheux Breech-loader. Single-grip.

breech, which covers the breech-ends of the barrels, being solid, is a shield and protection to the shooter.

The face of this breech receives the force of the explosion; it is kept up in position by the strength or thickness of metal under the breech-ends of the barrels. The lever being required only to hold the barrels down, thus, the hinge-pin keeps the breech-ends of the barrels firmly up to the standing-breech, when properly secured by the lever. It is very essential that the lever should be strong, so as to bind the barrels firmly to the action.

Lefaucheux's first gun had but a single grip, and this was about one inch from the hinge-pin, leaving that part unsecured that received

the greatest force of the explosion, which is close to the breech. The result of this was, that the breech sprang up a little every time the gun was discharged, and consequently made the barrels droop at the muzzle, which spoiled their shooting, besides causing a great escape of gas through the pin-hole.

This great defect was soon seen by English gunmakers, and improvements followed. Many methods were tried to remedy this evil, one of the

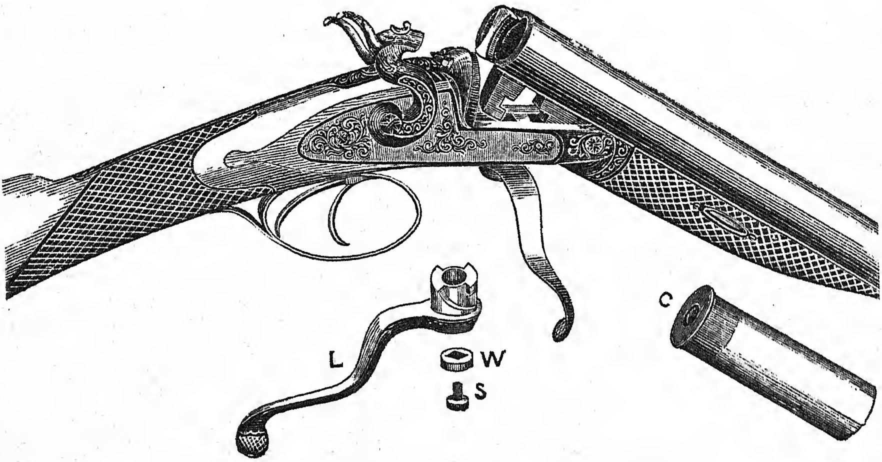


Fig. 160a.—Double-grip Breech-loader. Central-fire.

best being the double-grip action. This action is represented with its several parts in Fig. 160a.

It will be seen that the lever L is shown separate from the gun. This lever is secured in position by the screw S, and washer W to a pivot passing through the lever, the said pivot being solid with the action; there is a stop upon the washer, which allows the lever to travel one quarter of a circle only. When the gun is closed, the lever fits over the trigger-guard, instead of along the fore-end of the stock, as in the original Lefaucheux. This important improvement was effected by a Birmingham gunmaker, who omitted to patent this modification.

The improvements once started rapidly increased in number, nearly

every gunmaker having his own patent method of securing the barrels to the stock. We illustrate a few of the most striking to act as landmarks to future inventors; as enterprising gunmakers in the United States and elsewhere are advertising as their own inventions some of the same systems that have been tried and abandoned in England twenty years ago.

To commence with the sliding barrel, or Bastin's principle.

For loading Bastin's gun (Fig. 161) the barrels are pushed forward by a lever under the trigger-guard, or in the front of the stock, about three

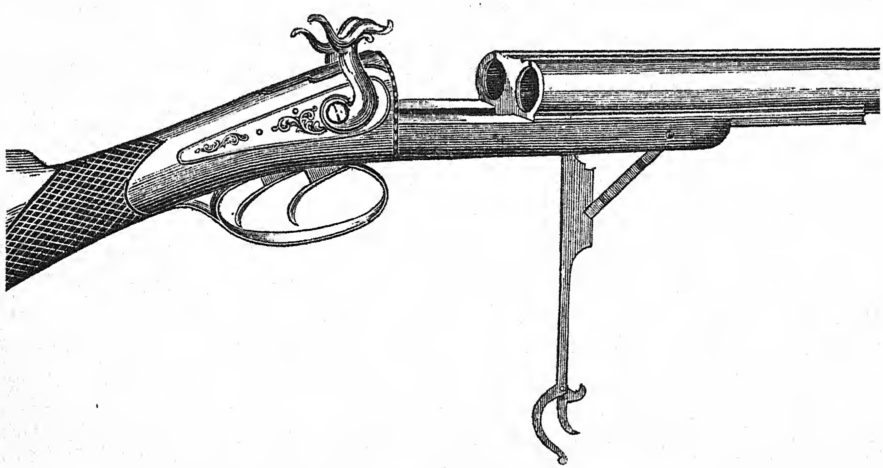


Fig. 161.—Bastin's Breech-loader.

inches from the breech, just sufficient to receive the cartridge case; the lever is then brought back into position, and fixes the barrels by a catch entering them underneath the stock, so as to prevent any forward motion at the moment of discharge. This plan was found to be insufficient to keep the barrels firmly against the false breech, and was soon discarded in consequence.

THE TURNOVER BREECH-ACTION.

In this breech-action, Fig. 162, the barrels are secured to the stock by a strong screw entering just below the extreme breech-ends; this screw

also acts as a pivot on which the barrels turn for loading. This is accomplished by moving them to the right, when the breech-ends of the barrels will be exposed to admit of the cartridges being inserted. The gun is represented in this position in the engraving.

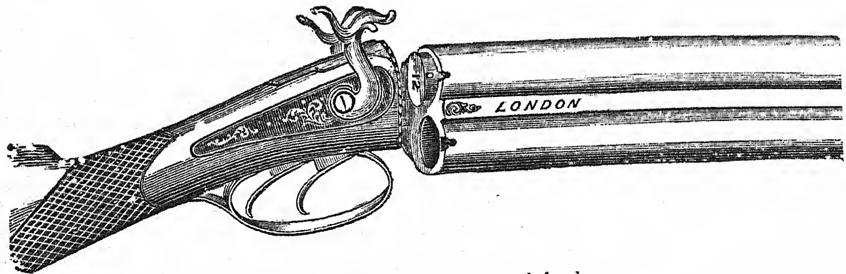


Fig. 162.—The Turnover Breech-loader.

When loaded they are turned in the proper place for firing, and secured by a bolt entering the rib. This bolt works in the break-off between the hammers. This is the simplest arrangement of all the four principles described here, but did not meet with much patronage, as it was only suitable for the pin-fire cartridge, and could not be made with bar, or as they are called, "front-action" locks.

THE SIDE-MOTION BREECH-ACTION.

This plan of breech-loading is, in our opinion, the next best to the drop-down or Lefaucheux principle for double guns. It was patented by Mr. Jeffries, of Norwich, about 1862, who after making it for many years has finally abandoned it. In Mr. Jeffries' gun the barrels were swung on a vertical joint-pin by means of a lever under the action, with an eccentric projection upon it that engaged in a slot in the barrels. The lever was similar and had the same motion as the double-grip lever already described. A gun on much the same principle, but without a lever, is now being extensively advertised by an American maker; but no amount of pushing will ever make this system a success, as both

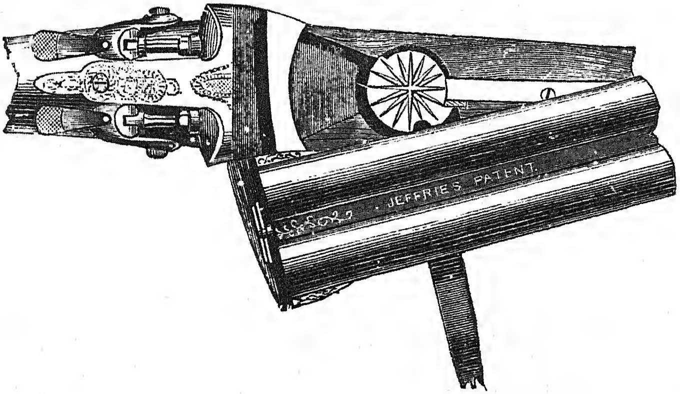


Fig. 163.—Jeffries' Side-motion Breech-loader.

gunmakers and sportsmen of every nation appear to have settled upon the drop-down system as the most convenient arrangement.

DOUGALL'S PATENT LOCK-FAST GUN.

The two motions, the sliding and the drop-down, are combined in the Dougall lock-fast breech-action.

The hinge is an eccentric rod connected with the lever. To disengage the barrels for loading, the lever is depressed. This moves the barrels forward about one-eighth of an inch, allowing the breech-ends to rise clear of the discs. When the cartridges are inserted the barrels are held in position until the lever is brought back, which secures them for firing. The barrels are prevented from rising by the discs, and a steel lump placed underneath the barrels, which engages in the face of the breech-action when the gun is closed. The discs too were advocated as a remedy for side motion of the barrels in a worn action. Now two wings or side stays projecting one on each side from the face of the breech-action are extolled as effecting the same end. A well-fitting top extension is a safer and more sightly remedy, for a fault that ought not to exist, and one that will very rarely, if ever, occur in a soundly fitted gun made on a reliable system.

CENTRAL-FIRE GUNS.

THE first gun on the central-fire principle appears to have been the Prussian Needle-gun, which gun had the detonating mixture distributed over a paper wad at the base of the bullet, the needle having to pass through the powder before reaching the detonator. It was invented by Herr Dreyse in 1838, and adopted by the Prussian army about 1842.

The original needle-gun is on the bolt principle, and resembles a common door-bolt in the breech-action. The first movement is to withdraw the needle by the thumb-trigger; the knob or bolt is then moved one-eighth of a circle to the left, and drawn backwards, which leaves

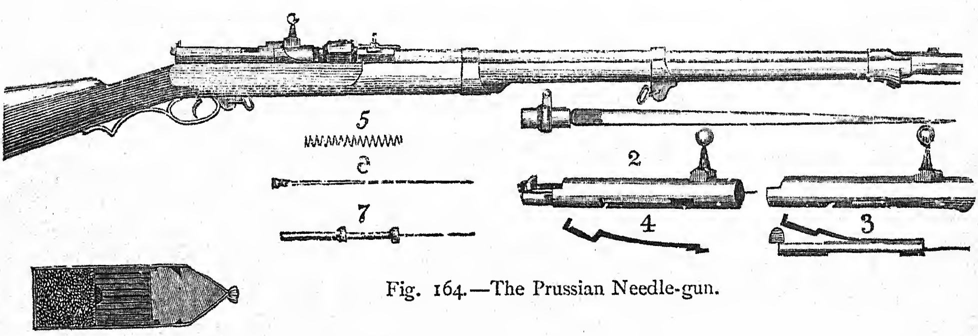


Fig. 164.—The Prussian Needle-gun.

sufficient opening to receive the cartridge; by reversing this motion the cartridge is pushed forward; the thumb-trigger is also pushed back. The piece is then ready for firing. The bolt is hollow—it contains the spiral spring and needle from which the gun derives its name, and by which the explosion of the charge is effected. By pulling the trigger, this needle is shot forward into a patch of detonating composition in the centre of the cartridge. The bullet is enclosed in a papier-mâché envelope, which answers the purpose of a wad, being about a quarter of an inch thick at the base of the bullet. The bore is No. 16. The patch of detonating powder is placed in the rear of the wad. The needle must, therefore,

pass through the charge of powder before it can reach the percussion composition. The whole of the cartridge is enveloped in strong paper, well lubricated with tallow.

DREYSE'S DOUBLE NEEDLE-GUN.

The first double central-fire gun was probably a modification of the Prussian needle-gun principle, and of which a representation is given in Fig. 165.

The gun is here shown open; when closed the lever lies underneath the fore-end of the stock. To open the gun the lever is depressed, as shown in the illustration; by this motion the barrels are thrust forward about half-an-inch, and allowed to rise clear of the breech, and the locks are cocked. The cartridges are then inserted and the barrels may be

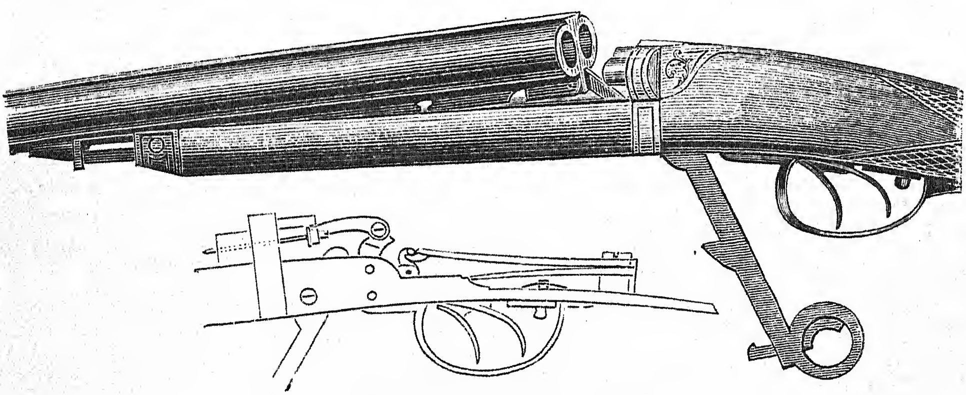


Fig. 165.—Dreyse's Gun.

closed, the lever returned to its position, and the gun is ready for firing. There is a small safety-bolt on the trigger-plate which works from behind and bolts the triggers. This gun is open to the same objections as the Prussian needle-gun, namely, the escape of gas at the breech, the fouling of the lock mechanism and needles, and its liability to get out of order. This gun was without hammers, and in all probability was the first double gun so constructed.

NEEDHAM'S CENTRAL-FIRE NEEDLE-GUNS.

About the year 1850 a somewhat similar gun to the foregoing was introduced by Mr. Needham, of London, but both the mechanism and the cartridges employed were superior to any modification of the Prussian needle-gun system.

Fig. 166 represents this gun closed, and Fig. 167 shows it open, and part of the mechanism pertaining to it.

This gun is loaded by turning the finger-piece, which lies in the fore-

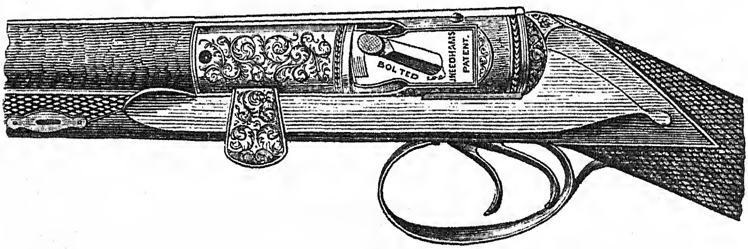


Fig. 166.—Needham's Central-fire Breech-loader.

part of the stock, round to the top of the barrel; this allows the "actions," or breech-blocks, to be opened sideways, they turning upon the hinge-pin, *b;* the cartridge is then inserted in the recess left vacant by the breech-block, and pushed up into the barrel, the breech-block is then

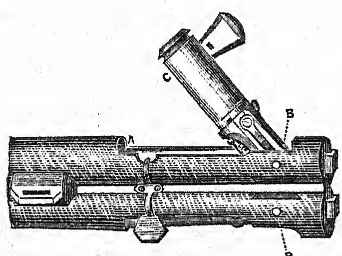


Fig. 167.—Mechanism of Needham's Gun.

returned to its place, the finger-piece depressed, and the gun is ready for firing. The process must be repeated to load the other barrel. The lock is contained in the breech-block, and consists of spiral mainsprings and

needles. The cocking is effected by the turning up of the finger-piece for loading. A safety-bolt was affixed to each breech-piece.

The cartridge used in this gun is the first to which we can trace the employment of a central-fire cap. The cartridge, as represented in Fig. 168, consists of two paper wads for the base; the cylinder is of ordinary cartridge paper, and the cap is placed on the inner side of the two wads, with its cup towards the base. The striking-needle when released penetrates the paper wads, and strikes into the cap. A thin zinc cap is placed over the wads to assist in strengthening the base. A hole is made in the

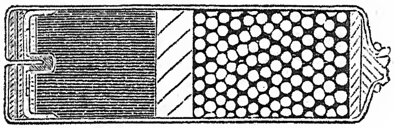


Fig. 168.—Needham's Central-fire Cartridge.

centre to admit the needle. The cartridge cases are not extracted, the paper cylinder being consumed during the discharge, and the base being pushed forward by the next cartridge inserted acts as a wad. This action is liable to fouling, by the escape of gas into the lock mechanism through the needle-holes. It met with considerable success, and is most probably the first English-made hammerless gun. This gun received but a very short run, being superseded a few years after its introduction by the central-fire systems of Mr. Lancaster and Mr. Daw.

THE LANCASTER CENTRAL-FIRE BREECH-LOADER.

This system was introduced by Mr. Lancaster about 1852; it differed from the needle-guns in construction of both the breech-action and the cartridge. The breech-action is shown in Fig. 169.

It will be seen th.. the breech-ends of the barrels are raised for loading; the cartridges are exploded by ordinary locks and hammers, the *shoulders* of which strike upon exploding-pins working in the false breech. The barrels are secured by a steel lump underneath them, projecting beneath the false breech where the barrels are secured. To open the gun, the lever

is moved to the right, and by means of an eccentric motion communicated by it to the barrels, they will be forced forward one-fourth of an inch, and the hook of the under steel lump will be brought to bear upon the hinge or joint-pin; and the other, or projecting extremity, withdrawn from beneath the standing-breech, the barrels will then drop down as in the Lefaucheux gun.

The cartridge (Fig. 169 resembles the Lefaucheux cartridge, but the ignition is effected by placing a copper disc perforated with four holes in the base of the cartridge, on which is spread the detonating powder.

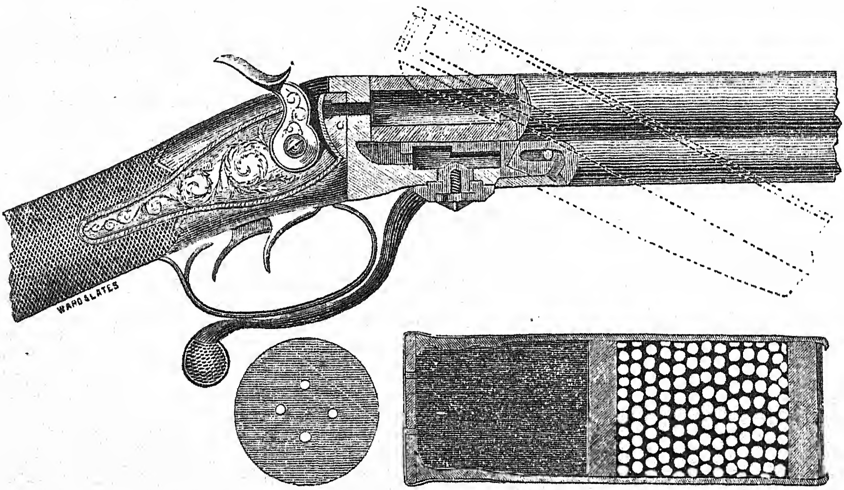


Fig. 169.—The Lancaster Central-fire Breech-loader, and Cartridge.

The whole of the base is covered with a copper capsule, which is thin in the middle where it receives the blow of the exploding pin, but stout at the edge, where it is somewhat wider than the diameter of the cartridge elsewhere.

The cases after firing are partially extracted by an extractor fitted between the two barrels, and acting upon the cartridge in the ordinary way. This gun is essentially the same as the central-fire gun, which became so popular and was in almost universal use from 1860 to 1880.

THE CHATEAUVILLIER GUN.

This gun was patented by the inventor, the Comte du Chateauvillier. The breech-block and lever is similar to the Demondion, Fig. 89.

After inserting the cartridge, the lever must be returned to its proper position along the grip of the stock, the breech-plugs being forced forward, closing the chambers.

The lock-work was arranged on the trigger-plate as shown in Fig. 170.

To cock the gun the lever is pushed on to its centre, which causes

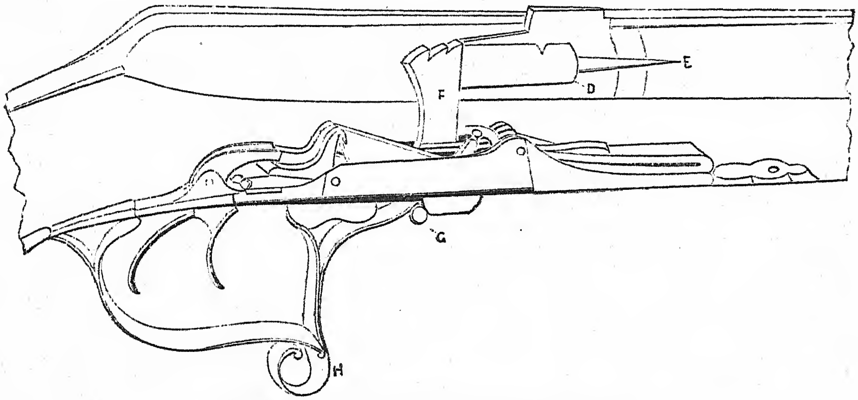


Fig. 170.—The Chateauvillier Breech-loader.

it to act upon the lower extremity of the hammer or tumblers; in the above illustration one hammer is shown discharged, the other at full cock. The blow is given by the hammer to the plug, and communicated by its elongated extremity to the cartridge, which differed only from that used by Mr. Needham in having the cap with its cup towards the powder.

DAW'S GUN AND CARTRIDGE.

The central-fire cartridge which is now in universal use, was invented by M. Pottet of Paris, and after being (it was said) improved and patented in France by a M. Schneider, introduced into this country by Mr. C. H. Daw, the well-known London gunmaker, about 1861, who also intro-

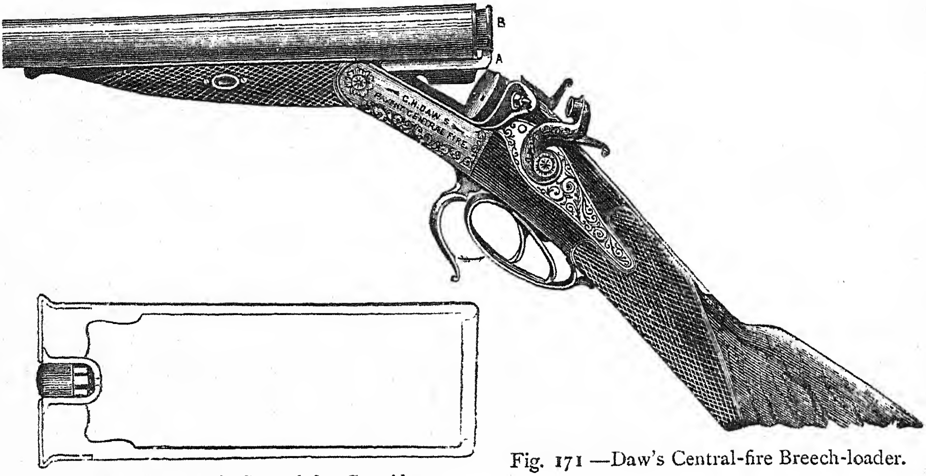


Fig. 171.—Daw's Central-fire Breech-loader.

Fig. 172.—Daw's Central-fire Cartridge.

duced with it the central-fire gun of the accompanying pattern (Fig. 171) which is so well known that no description is necessary. Mr. Daw was the only exhibitor of central-fire gun cartridges at the International Exhibition of 1862, for which he was awarded a prize medal.

THE ADVANTAGES OF THE CENTRAL-FIRE SYSTEM.

The greatest advantage gained by the central-fire principle is the non-escape of gas at the breech; the next is cleanliness; there is no pin-hole in the barrels to let in the wet. This pin-hole is a great objection, as the pin must fit into the notch in the barrels before the barrels can be closed. In very rapid loading, and during excitement in battue shooting, or when after dangerous game in wild countries, this would cause delay in fitting the cartridge properly. The central-fire plan greatly simplifies loading and unloading. It is often difficult to extract a tight-fitting cartridge from a pin gun, especially when the gun is foul; this is another cause of delay. The cartridges are not so handy to carry, on account of the projecting pin, as the central-fire.

The introduction of the central-fire system into this country met with considerable opposition from many sportsmen, who asserted that the

system was dangerous, as they could not see at a glance if the gun was loaded. Gunmakers patented indicators, or small pins that protruded through the breech-action when the gun was loaded: they were, however, soon discarded as useless and unnecessary appendages.

It is surprising how rapidly the central-fire gun came into favour, notwithstanding the opposition raised by over-cautious sportsmen. Eighteen years afterwards we find the same objection raised against the hammerless guns, with the further objection that they can neither see when they are cocked or loaded. To meet this objection, some gunmakers have to affix the old-fashioned indicators, to show when the gun is cocked, whilst another provides a small window in each lock-plate, in order that the shooter may inspect the lock mechanism, and ascertain which barrel has been fired. The best and simplest way is to open the gun and glance at the cartridge, which is only the work of a moment. Indicators are certainly a mistake. If every sportsman would observe the admirable rule of treating a gun as loaded until he has satisfied himself that it is not, the risk of accidental explosions would be reduced to a minimum. There cannot now be the slightest excuse for leaving a breech-loader with a loaded cartridge in it, on putting the gun aside when the day's sport is ended; and doing so should be considered a penal offence in any case. One of the great advantages of the breech-loading system is that guns can be so readily loaded or unloaded, that if only a moderate amount of care were exercised, accidents with them would become very rare.

MODERN BREECH-ACTIONS.

Modern shot guns are generally made with snap or self-locking actions; in the snap principle, the locking-bolt is forced into the bites or grips by a spring upon the gun being closed. We believe Mr. Needham, of London, was the first to introduce this system; his first snap gun, made about 1862, was so constructed, that upon depressing the lever for opening the gun, the hammers were raised to half cock. The lever lay along the right-hand side of breech-action, with the thumb-hold pointing towards the muzzle. About 1864 we invented a self half-cocking snap breech-action, shown in Fig. 173. It was of simple construction, the locking-bolt working in

the top of false breech, and engaging with the barrels immediately below the top rib. This action stood a great amount of hard work, especially in the heavy large-bore rifles used in India. We give an illustration of this, our first patent breech-loader, showing as it does the crude idea of the top connection between barrels and break-off, and for comparison with our last patent, to show the great improvements that have been made during the last twenty years.

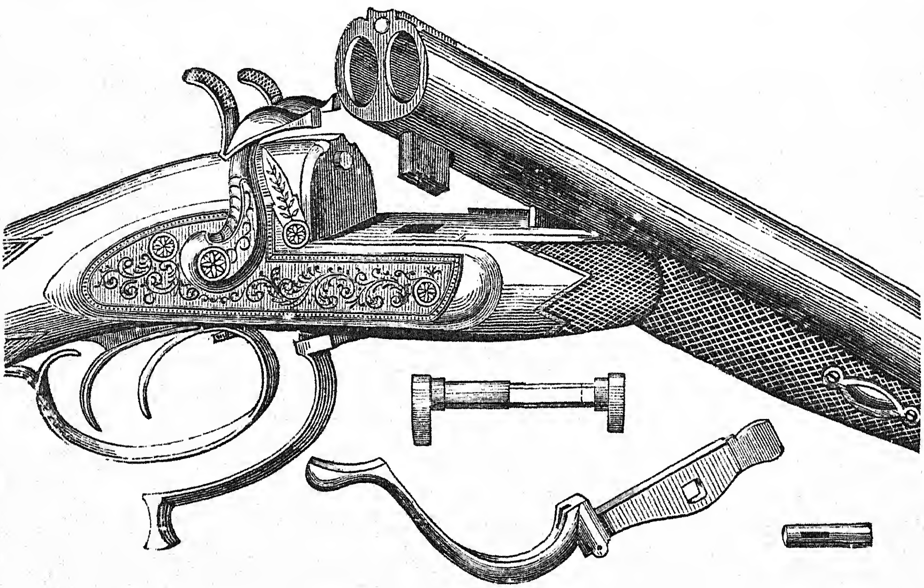


Fig. 173.—Self Half-cocking Gun.

One of the next, and for a long time the favourite breech-action of the American and London dealers, was the side-lever snap-action.

It is simple, strong and handy; an illustration is given in Fig. 174. The principal objection to it is, that the position of the lever makes it difficult, under some circumstances, to raise the left-hand hammer to full-cock.

In the illustration, the bolting apparatus is shown apart from the gun, L is the lever, S the lever-spring, E the extractor, B the holding-down bolt, shown single, but it may be constructed double, so as to engage in the

grips of both the back and front lump. The spring is very simple and strong, and lies underneath the body of breech-action.

The breech-action, with the lever upon top of break-off, was shortly afterwards introduced, about 1860, and a modification of the principle is still in great favour with all modern sportsmen. The advantages of the top-lever are undoubtedly numerous; with it, it is possible to carry the gun in any position, without catching or displacing the lever; with it, at a glance, the sportsman can see if the gun is properly closed and the lever home; for handiness, it is unexcelled:

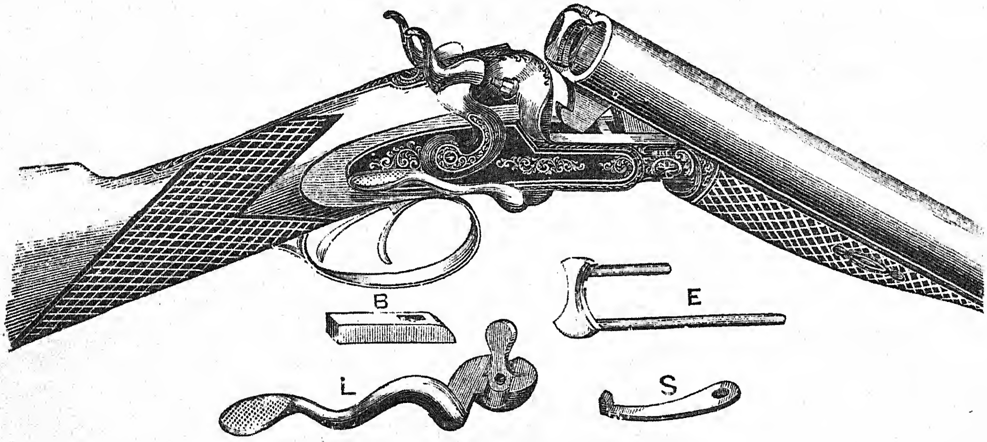


Fig. 174.—Side-lever Breech-loader.

the thumb has only to move the lever to the right, and the barrels are disengaged; the leverage obtained is very great, sufficient to cock both locks, as may be seen upon referring to the hammerless gun, Fig. 233. Another advantage is, that the hand, after firing the gun, may easily move the lever and disengage the barrels, without being moved from the grip of stock; a variety of bolts have been arranged to work with this top-lever, the most common being the Purdey double bolt. An illustration of a gun with this action, and bar or front-action locks, is shown in Fig. 175.

The locks are now fitted with our low hammers, so much in favour for fine guns.

When building guns upon this principle, great care should be taken

to leave plenty of metal in the breech-action, between the locks and the barrels, as the large amount of metal it is necessary to cut away, to admit of the locks and bolting mechanism, tends to considerably weaken the gun;

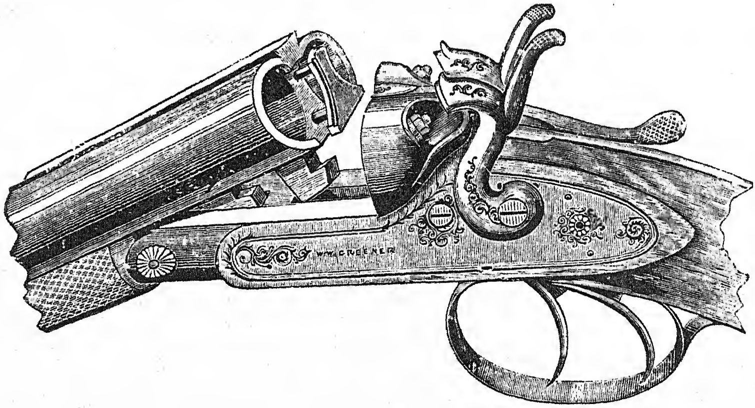


Fig. 175.—Bar Top-Lever Breech-Action.

with back-action locks the breech-action is considerably stronger, the metal being left solid under the barrels and false breech, as shown in Fig. 176.

Many sportsmen, however, object strongly to back-action locks, on

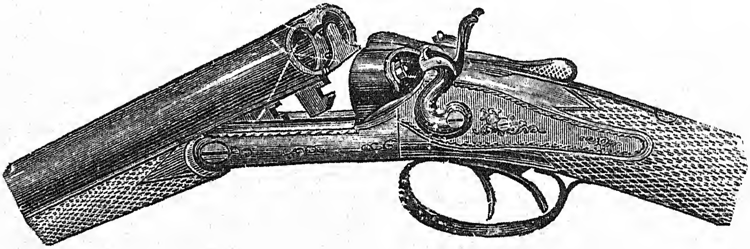


Fig. 176.—Top-Lever Gun with Back-action Locks.

account of their appearance. They also tend to weaken the stock at the grip more than the front-action locks, the wood having to be cut away in the grip to admit the mainsprings.

The sportsmen of Cape Colony are much opposed to guns with back-action locks, as riding upon horseback and subjecting their guns to very

rough usage, they continually break the stocks, unless strong in the grip and made with fore-action locks.

Guns are made upon this principle with single, double, and treble grip-bolts. The double bolt is the best, as the single bolt is liable to spring, which is provided against in the double bolt by the longer bearing surface, which also causes the gun to close much more evenly and pleasantly. The treble bolt action, with all the bolts at the bottom, cuts away so much metal from the lumps and the action under the barrels as to weaken them, and make them of less service than in a well-fitted double-bolted action.

The top-lever may also be used to move top-bolts, as in the Westley Richards' patent breech-action shown in Fig. 177. This action secures the

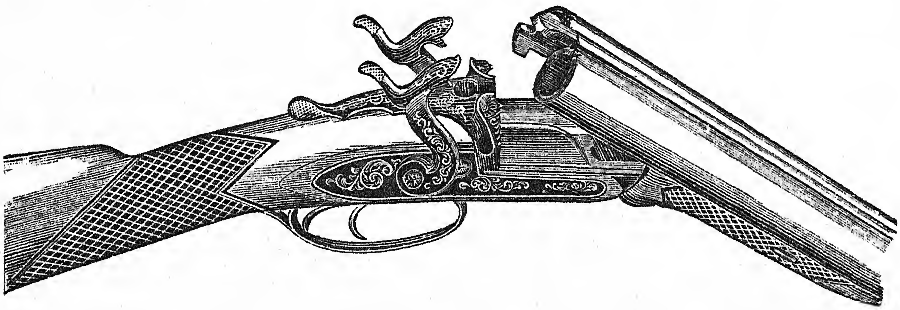


Fig. 177.—Westley Richards' Patent Breech-loader.

barrels to the top of the breech-action. The hook which extends beyond the barrels from the rib is a kind of dovetail, which fits into the standing-breech when in position for firing. The bolt or catch slides in the strap of break-off, and engages in a slot at the top of the hook; this bolt is pushed forward by a spring behind it, and is disengaged by pressing the lever to the right. The intention of this particular arrangement is to prevent the springing back of the standing-breech at the moment of discharge.

This gun was patented in 1862, and was a step in the right direction, for we have long advocated a top connection between the barrels and break-off. We invented a cross-bolt about 1865, that passed through an extension top-rib, and in 1873 we patented a combination of this top fastening and the double Purdey bottom-bolt. This invention consisted,

in moving the top cross-bolt transversely, and drawing the bottom-bolt backwards with the same motion of the lever.

The main feature of our treble wedge-fast breech-action is the top cross-bolt, which in combination with the bottom double-bolt, has proved the strongest, handiest, and most durable modification of the drop-down principle.

This gun, Fig. 178, received an editorial notice in the *Field* newspaper of December 5th, 1874, from which the following extract is taken :—

"We have previously noticed the guns of Mr. W. W. Greener, of St. Mary's Works, Birmingham, the strength of which, at the time of our former notice, mainly rested in the

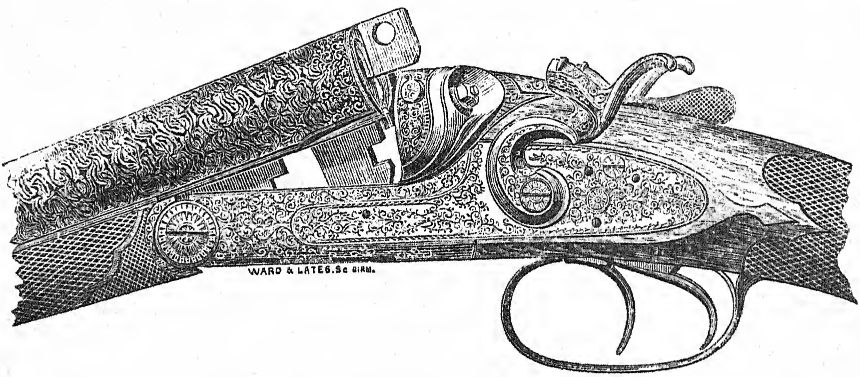


Fig. 178.—The Patent Treble Wedge-fast Gun.

cross-bolt, which is driven into the projecting rib, as shown in the annexed diagrams. The present guns vary only in the levers by which this cross-bolt and the additional double-grip are moved, and in the locks employed. Having always contended for the advantages accruing from this top connection between the barrels and the false breech (which Mr. W. W. Greener's action possesses in common with that of Mr. Westley Richards), we need not refer to it further than to remark that the double-grip now employed forms, with the cross-bolt, the strongest development of the Lefaucheux action with which we are acquainted."

Many gunmakers are jealous of the great success this gun has met with, and have brought forward numerous imitations of this system, but to avoid the patent they have been obliged to omit the particular points on which the main strength and efficiency of the invention depends.

Most of these would be treble wedge-fast guns having well sounding

appellations, such as "giant grip fast," "treble lock fast," "triple grip fast," "climax grip"; all are weaker than the original, and in some the top connection is but an apology.

To show the advantage of having a secure top-fastening, we will endeavour to point out the weakest part of the breech-action. The accompanying illustration, Fig. 179, shows in section an ordinary 12-gauge breech-action, with the bar locks and furniture removed. It is cut through just at that point where the greatest strain is exerted. The metal is shaded, and the reader may easily judge if so small an

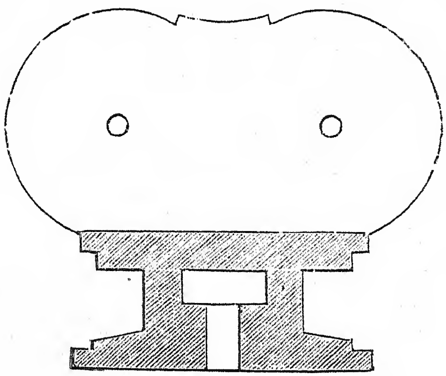


Fig. 179.—Section of Breech-action.

amount of metal is able to withstand the great continued strain of firing heavy charges. There are several means of remedying this evil.

First, by leaving more metal in the breech-action at this point (between the barrels and locks), which is considered by most gunmakers and sportsmen to spoil the appearance of the gun in a great measure.

Secondly, by using back-action locks. We have already pointed out the great objection raised to them, so that by far the least objectionable, and at the same time the strongest way, is to affix an efficient top connection between the barrels and break-off, and none is so strong as our patent top-cross-bolt, which has been proved by actual experiment to add enormously to the safety and wear of a gun. Occasionally the barrels part from the stock when there is no top connection,

the breech-action breaking completely through. The value of this breech-action for such purposes as double rifles, especially those of large calibre, duck and pigeon guns, and even punt guns, cannot be overrated.

This month have we received additional testimony of its efficacy for this purpose. A double 8-bore rifle weighing 17 lbs., and a double 4-bore weighing 19 lbs. smooth-bore, were made on the treble wedge-fast principle by us in 1874 for Mr. G. P. Sanderson, superintendent of elephant Keddahs, Decca, and have since been continually used, firing 2-ounce bullets with 12 drams, and 4-ounce bullets with 16 drams respectively, and each rifle several hundreds of times, and to quote Mr. Sanderson, "the breech-action are as sound and close as when they left the factory nearly 10 years ago.' To our knowledge a rifle maker of good reputation essayed to make one of these "large rifles" to shoot a short conical bullet, using a double grip breech-action and a doll's head extension of top rib. Three breech-actions were fitted successively, and all were broken or strained beyond use in the preliminary trials, and the prospect of getting one to stand the heavy charges was so remote, that the idea had to be abandoned.

It has now been in use ten years, and has achieved a very high reputation. The demand for this breech-action is yearly increasing, especially in the United States, where large charges are the rule, not the exception. For light guns and small bores, where weight is an important object, its advantages are again pre-eminent, as the greater strength given to the action by the bolt allows of less metal being used in the action, without in any way affecting the safety or lasting power of the gun. The strain on a 16-bore and 20-bore breech-action has been found by actual experiment to be greater than on a 12-gauge, and the amount of injury to the breech-actions of small, light guns, from using the Schultze wood and E. C. powders, is in greater proportion than with the 12-gauges.

The following experiments made immediately upon the close of the 1878 *Field* trial of explosives by the editor of the *Field*, we reprint in full:—

"THE BREAKING STRAIN OF POWDERS ON GUN ACTIONS, &C.

"Among our various remarks referring to the then proposed trial of explosives, &c., we stated that we intended to show the superior strength of the top connection between the barrels and break-off of hinged breech-loading guns over the bolt at the base. Mr. Greener's action happening to combine these two bolts in such a way as to allow of

their separate use, we had a 10-bore so constructed by him that the top-cross-bolt (*d*) could be readily removed from its hole (*c*) or applied at will. This allowed of one barrel being first fired with the bolt in position, and then, after removing the bolt, firing the other. To this action we had a little apparatus fixed, as shown in the accompanying engraving (Fig. 180).

"By this arrangement a piece of silver paper can be strained between the hook (*b*) on the break-off and the screw-clip (*a a*) attached to the barrels, so that when any separation takes place during an explosion, the paper breaks. To prevent the possibility of any doubt as to this being caused by the jar of the explosion, both barrels are loaded equally, after which one is fired with the bolt in, and then, supposing no breakage occurs, the bolt is removed and the other barrel discharged.

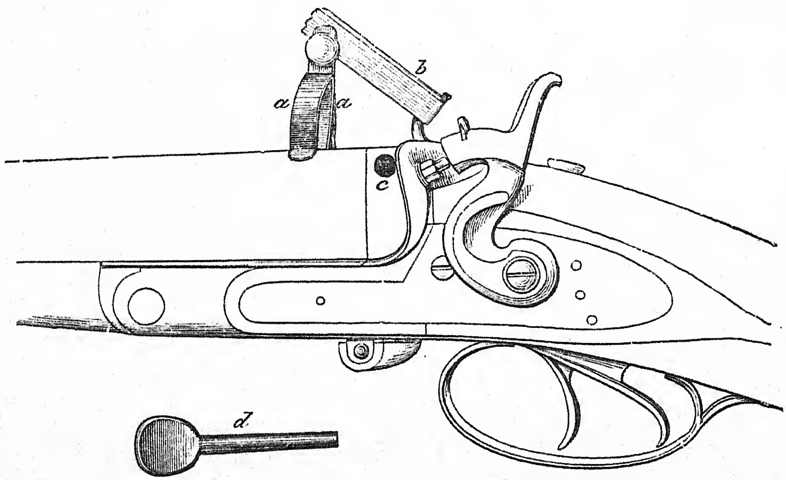


Fig. 180.—Experimental Breech-Action.

"Experimenting in this way, we found that in Mr. Greener's action no breakage occurred either with the bolt in or out, using any charge of powder which the cartridge-case could be made to hold, until we charged it with sixty grains of the 'Blissett' sample of Schultze powder, considerably compressed, a thin felt wad, and two ounces of shot, when the discharge of the first barrel (with the bolt in) produced no effect on the paper, but on removing the bolt the second discharge broke it up completely. Repeating this experiment, the same result again occurred, which we considered conclusive as to this powder. After this we confined our experiments to the Schultze of 1877-8, that of 1878-9 used at the recent trial, and Nos. 3 and 6 of Curtiss and Harvey's black powder, as follows: the shot in each case being 2 oz. No. 6, introduced from the muzzle after charging the cartridge case with powder and an ordinary felt wad. In each case the bolt was in position with the firing of the first barrel, and was removed afterwards; but with the bolt in position the paper remained intact up to the last.

	Powder.	Result.
1.	5 drachms Curtiss and Harvey No. 6	No breakage.
2.	„ „ „ No. 3	Ditto.
3.	55 grains Schultze 1877-8	Ditto.
4.	„ 1878-9	Ditto.
5.	6 drachms Curtiss and Harvey No. 3	Ditto.
7.	65 grains Schultze 1877-8	Ditto.
8.	„ „ 1878-9	Slight breakage.
9.	7 drachms Curtiss and Harvey No. 3	Ditto.
10.	75 grains Schultze 1877-8	Complete breakage.
	„ „ 1878-9	Ditto.

"In the last case there was not only complete breakage of paper, but such a permanent opening of the breech of the gun as to stop the experiment."

Had the cross-bolt been kept in during the whole trial, it is evident no breakage of the paper could have occurred. This shows conclusively the great strength and advantage of the top connection.

Mr. J. H. Walsh in his work on the "Modern Sportsman Gun and Rifle," Vol. I., writes in flattering terms of this action, whose advantages he was one of the first to demonstrate, and even contemporary gunmakers now acknowledge its merits.

NECESSITY OF A TOP CONNECTION IN HAMMERLESS GUNS.

Since the Anson and Deeley Hammerless Gun has been introduced, the distance from the face of the breech-action to the hinge-pin has been considerably shortened, to allow of greater leverage being obtained to cock the locks. On account of the breech-action being so much shorter, the top connection to the barrels is of great importance, this gun being more liable to gape at the joint than ordinary guns with greater length of breech-action: in fact, this gun cannot be made to stand continual firing unless strengthened with a good top fastening.

In the spring of 1878 an opportunity of submitting our Treble Wedge-fast Hammerless Gun to a severe test presented itself, by supplying Dr. W. F. Carver with one of these guns for his exhibition shooting. In his hands this gun was shot upwards of 200 consecutive days, during which upwards of 40,000 shots were discharged from it, many of them being large charges of either black or Schultze wood powder. This was done without either the locks or breech-action being stripped for cleaning or

repairs. The action stood remarkably well, and was not tightened up during the whole period. This gun was used continually by Dr. Carver for two years, upwards of 130,000 shots being fired from it. This test was the most severe a gun could possibly be submitted to, and as a wear-and-tear trial it is of the greatest value, being equal to the wear experienced by an ordinary gun during forty years' game-shooting; and in all probability no other breech-action on the drop-down system would have stood the great continued strain.

Any gun with a *well-fitting* bolted top connection is vastly superior to those with bottom-bolts only, or with extension of the rib without any bolt

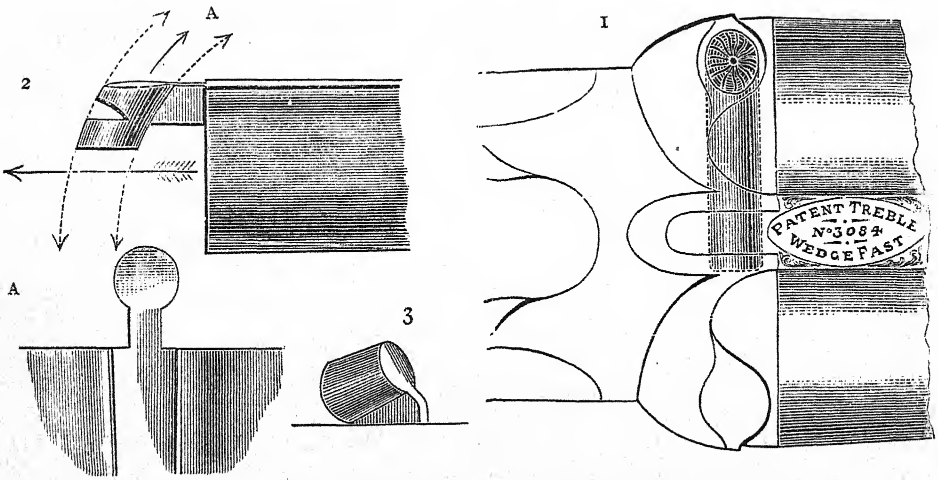
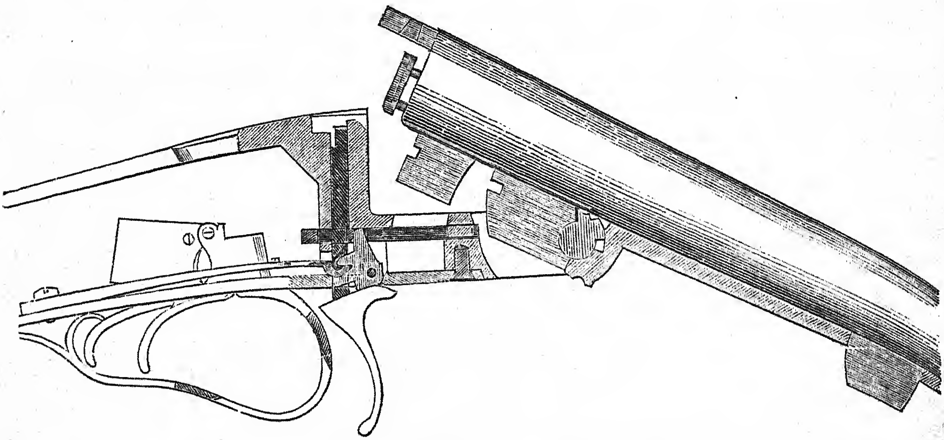


Fig. 181.—Top Connections between Barrels and Breech-actions.

fastening into it. Many of these guns are annually made with top-levers and single or double-bottom bolts. This top extension is in the shape of Nos. 2 and 3, Fig. 181, and is known as a "doll's head;" it fits into a mortice in the top of standing-breech. The intention of this extended rib is to prevent the springing back of the standing-breech at the moment of discharge; when made as No. 3 we have proved by experiment that it is utterly useless, having no bite whatever. No. 2, an accurately fitting head in a circular mortice, should only loosen from its

bearing when moved in the direction of the arrow in the arc A, A, if the barrels are firmly secured by holding bolts, the hook and sides of the doll's head will assist slightly in taking the strain of the discharge, which is cross-wise in the direction of the dotted arrow; but owing to the expansion of the metal in the barrels the doll's head is lifted in some measure from its bearing, and its worth lost ; a doll's head with a bolt in it is preferable to one without, but both fall a long way short of the through cross-bolt of the treble wedge fast, shown in No. 1.



The Abbey Breech-loader.

Another form of top-bolting lately revived by the Editor of the *Field* and Mr. Rigby in their hammerless guns, is shown in the Abbey breech-loader, an American invention of some twenty years ago. It is a vertical bolting, binding vertically a flat extension of the top-rib to the breech-action. It is more secure than the doll's head, for the expansion of the barrels being upward, and the strain on the breech-action backward, the bearing of the bolt remains unaltered at time of the explosion.

GUN-MAKING—HISTORY AND DESCRIPTION.

GUN-BARRELS.

In the earliest firearms the barrels were made of plain iron, usually from one strip, which was bent, whilst hot, round a mandril, and the two edges welded together. Later on two pieces were used, one for the breech-end of the barrel, the other for the fore-end, or muzzle-piece. In some old blunderbusses the breech-piece is of iron or steel, and the muzzle-piece of brass or bell-metal. Plain iron barrels were drawn as early as 1808, when one Benjamin Cook patented an invention for making barrels for fowling-pieces, muskets, &c. His plan was to roll a block of iron or steel, and drill a hole through it: a mandril was placed in this hole, and the bar drawn, whilst red hot, between rolls with taper grooves into a barrel of the required length. The breech-end of the barrel was first formed, the roller watching his opportunity, and inserting the bar of iron when the broad section of the groove presented itself. This plan is the one now in use for Bessemer steel rifle barrels and decarbonised steel shot barrels; but the hole now is punched through the bar or block of metal, and afterwards gradually drawn out upon a mandril. By this principle a barrel is obtained without a single weld in it, and a material saving thereby effected. This plan of rolling was discontinued after a few years; the method adopted in its stead was to roll the barrel out of a short strip of iron, which was turned round a mandril and drawn through rolls, the edges being welded whilst passing between the rolls; this mandril is only used to start the barrels, and is not drawn through the rolls. This plan was used for several years, all the military barrels being made this way, the weld running straight along the barrel on the under-side. It has since been discontinued for all but the very common barrels, the rollers having reverted to the plan first described. In the patent of Benjamin Cook there is also a plan for rolling rifle barrels with the grooves in. To accomplish this the barrels are rolled or drawn with fluted bars inside them; the barrels receive grooves from the flutes of the bars, and are to be afterwards twisted until they have the required amount of spiral. All

plain-drawn barrels have the fibre running straight along the barrel, not round. This is certainly the best for all barrels that are intended for rifling, for, although the plain iron or steel will not stand so great a strain as the twisted metal, yet in rifle barrels there is generally a large body of metal required in the barrel to counterbalance the recoil, so that they very seldom give way, and may be advantageously used for such purposes, as the spiral grooving does not cut across the grain of the iron, whereas in a twist barrel the grooves run in a transverse direction to the fibres of the metal. For shot barrels plain metal is altogether unsuitable, there not being sufficient thickness of it to obtain the strength necessary to withstand the strain of the explosion. The cold-drawn steel barrels made in 1865 and the few following years were far superior to the plain iron and decarbonised steel barrels generally used. These barrels were drawn out, whilst cold, from blocks of steel, by pressing them with punches through orifices. They could only be drawn out an inch or two at a time, and required annealing each time before placing in the machine. Owing to the slowness of the process, and the heavy expenses incurred by the great wear upon the tools and machinery, the company were unable to manufacture at remunerative prices, and consequently closed after a few years. Next in quality comes the "solid fluid compressed steel" barrel, as made by Sir J. Whitworth, which withstands heavy charges better than any plain metal barrel now used; but they are very expensive, and not well liked, for they, in common with other plain metal barrels, show no figure whatever when finished, but resemble in appearance a musket barrel. Gentlemen are unable to tell whether they possess a genuine "fluid steel barrel," or whether the gunmaker has used instead (at one-third the cost) a common steel barrel; whereas with a twist barrel the sportsman can easily tell the quality of his barrel by the fineness of the figure. For this reason the plain iron barrels will never become popular for best shot guns whilst good laminated steel or Damascus barrels can be obtained. The first notice we can find of iron and steel as used conjointly as a metal for gun barrels is in the letters patent of William Dupein (1798). His method was to lay round a rod of iron a strip of steel, then a coating of iron or "iron and steel mixed." The whole was then welded together, and the iron cores bored away so as to leave the barrel of steel, or steel and iron, as required. A few years later, old horsenails were greatly in vogue for the manufacture

of gun-barrels. The nails have always been made from the very best iron, and are also considered to obtain some virtue from the contact with the horse's hoof. The nails were welded together into a straight or taper bar, which was lapped over a mandril and welded into a tube. These barrels held a high reputation at the commencement of the present century. They may easily be distinguished, being figured barrels; the figure runs longitudinally with the barrel, the nails being light, and dark lines at each weld. We believe that in horseshoe nail stubs was the first successful attempt at a figured barrel. In 1806 a J. Jones patented an improved method of manufacturing gun-barrels. He made the barrels by *twisting* a scelp with bevelled edges round a mandril, so that the edges overlapped each other, and then welding together the edges of the scelp. Once introduced, the manufacture of twisted barrels increased rapidly in importance. Scelp or plain rods were first twisted, afterwards the horseshoe nail stubs were twisted in the same manner, and the introduction of Damascus barrels followed shortly afterwards. The manufacture of barrels from scrap iron with tilt hammers was in its prime about 1845, when John Clive, the noted barrel-maker, kept a mill in Birmingham, turning out large quantities of barrels weekly, by which he achieved a good reputation and a considerable fortune.

LONDON GUNS.

Many years ago best twist barrels were manufactured in the city of London, but they could not hold their own with the Birmingham welders, and, since the year 1844, no gun-barrel welder has continuously practised his trade within the vicinity of the metropolis. The last barrel-maker of note was William Fullard, of Clerkenwell—a man of high reputation for all kinds of sporting barrels. The cost of producing guns is very much greater in London, for the following reasons. The rents, taxes, rates, and cost of living are much greater than in Birmingham. The barrels, locks, and raw materials have all to be purchased through dealers from either Birmingham or Liège. The guns really got up in London are all high-priced ones, for the simple reason that they cannot manufacture medium grade or common guns so cheap as they can buy them from Birmingham makers. Therefore all new guns purchased in London under twenty guineas

are necessarily of Birmingham manufacture. The London Proof House is mainly supported by the Birmingham makers who manufacture for the London and country trade. From these statements it will be apparent that the London gunmakers must get proportionally higher prices for their manufactures to cover the increased cost of production. They say that they pay higher prices for their work than is paid elsewhere, which is quite true; but they employ various hands, and in most cases the workmen change about from Birmingham to London. The statement frequently made by London makers that they employ better workmen than may be found in Birmingham is untrue. Frequent opportunities of viewing the guns of some of the best London makers have occurred, and they have been found in no way superior to the best Birmingham-made guns. Men that have left our service have readily been employed by the first London makers, and have afterwards returned to Birmingham, being unable to live so well in London, although receiving higher wages. The greater portion of the London gun workmen are either Birmingham men, or have learned their trade here. The most valuable improvements in sporting guns during the last century have emanated from Birmingham, where the keen competition sharpens the inventive genius, and every opportunity is afforded for testing improvements, the gunmakers aiding and encouraging all inventors. Birmingham has made many more improvements in all appertaining to guns than London. To enumerate here a few of the leading improvements introduced by the Birmingham gunmakers since 1790:—The improved method of straightening gun-barrels; the patent twist barrel, and the invention of laminated steel; the rolling of military gun-barrels; the drawing of gun-barrels from a solid block of steel; the expansive rifle bullet (Greener); double-action revolving pistol (Tranter); the Terry and Westley Richards' breech-loading carbines; the double-grip breech-action; top-lever and top connection breech-actions; the rebounding gun lock; the first successful hammerless gun; successful choke-boring (Greener); top-lever ejecting hammerless guns; &c. &c.

These improvements, together with the indefatigable exertion of some of the leading gunmakers, have served to remove in a decided manner the stigma which, until a few years ago, rested upon all Birmingham-made guns; and it is now a well recognised fact that guns are made in Birmingham fully equal in every respect to the best guns the

world can produce. Birmingham turns out more first-class guns than any town in the world. The finer grades of guns made here are in ever-increasing demand, in several colonies have a higher reputation, and sell for more than the costliest guns of any London maker. They have been supplied to the Royal families of Europe and Asia, and are extensively patronised by practical sportsmen and professional shooters.

MANUFACTURE OF IRON FOR GUN-BARRELS.

The iron for the manufacture of gun-barrels was formerly made from scrap and old horseshoe nail stubs. In preparing the metal for the old-fashioned laminated steel barrels, a number of scraps were collected of various proportions, the clippings of saws, steel pens, scraps of best iron, and placed in a revolving drum, where they were polished by the constant rubbing against each other. The scraps were then cut into pieces of the same size, and placed in a furnace until of a white heat, gathered into a bloom with ravels, and the mass placed under a tilt hammer, and welded into a block of iron which was immediately rolled into bars. The bars were then cut into regular lengths, and the required quantity laid together and fastened into a faggot, and this faggot was again heated in the furnace, hammered under the tilt, and rolled into rods of the size required by the barrel welders. The modern way of preparing the metal for gun-barrels is to make the whole from new metal, as follows:—Pig-iron obtained from a mixture of the best ores is placed in a furnace, melted, and cleansed from all dross by puddling—the dross, being much lighter than the iron, rises to the surface, and is skimmed off. When sufficiently cleansed, the drawplates of the furnace are lowered, the heat reduced thereby, and the liquid iron whilst cooling gathered and worked into blooms of about 1 cwt. each. The puddler takes the bloom with a pair of tongs, runs with it to the tilt hammer and hands it over to the shingler, who by dexterously turning the metal under the hammer forms it into a square block and passes it to the roller ; it is then passed through the various rolls until of the required size, and drawn out into a bar of about 10 feet in length. The hammering under the heavy tilt condenses the metal, and causes the dross and scale to fly off. The rolling increases its ductility and tenacity by elongating the fibres. The steel is prepared in the same way from the

best Swedish pigs, but the metal is considerably improved by the hammering and rolling, becoming much more tenacious and elastic in proportion than the iron.

The loss in the puddling is about 15 per cent., in the shingling and rolling about 14 per cent.; in re-heating the metal it also loses considerably, making a loss of about 40 per cent. in those three processes alone; and there are successions of similar losses in each further stage of the manufacture of iron. The bars are cut into equal lengths, laid together and fastened into faggots, these faggots are heated in the draught furnace, welded under the tilt hammer, and the block of metal is re-heated and hammered for the manufacture of the best barrels, to condense the fibre of the metal and increase the specific gravity. After being hammered the blocks are rolled out into bars; these bars are again cut into equal lengths, laid and fastened into faggots, heated in the furnace, and welded together and rolled into thin narrow strips. In the above processes the ends of the bloom, or extremities of the rods, are cut off and thrown aside, being less dense and consequently useless for gun-iron.

The iron is now again cut off into equal lengths, and laid together and fastened into faggots, heated and welded, and drawn out as before described, and rolled into rods of the sizes required by the welder. The faggots are each heated seven times during the process of manufacture of the metal for the best barrels. The proportionate amounts of the different descriptions of metal in a barrel determine its quality. The old-fashioned laminated steel was composed of nearly three parts of steel; best English Damascus and modern laminated steel contain over 60 per cent. of steel; and the best silver-steel Damascus contains nearly 75 per cent. of the best worked steel. The amount of steel is determined upon before making the metal into faggots for the last time; if for scelp barrels the strips of iron are twice the thickness of the steel, the faggots being formed of alternate layers of iron and steel. In single iron Damascus barrels the proportion of iron used is not much less than the steel, but the metal for these common barrels does not pass through quite so many processes as that for the best barrels, and, although far superior in quality to ordinary iron, its tenacity and specific gravity is not so great as that of the very best gun-iron. In best Damascus barrels the iron and steel are mixed together systematically. Our silver-steel Damascus is mixed in a different

manner to that of Damascus, the exact proportions of iron and steel being used as have been found by experiment to give the greatest strength with the finest figure. The tenacity, durability, and beautiful figure of the barrels depend almost entirely on the proportions and arrangement of the steel and iron, the desiderata being the placing of the iron in the best position to give the regular and fine figure in the finished barrel.

Too large an amount of carbon in gun-iron is more detrimental than a scarcity, for where carbon has once been it is impossible to entirely eradicate it, and although it may be extracted to as great an extent as possible, it leaves a residue that possesses an affinity to re-absorb carbon fully equal to the original quantity; thus steel, however manufactured, cannot by any process yet discovered be re-converted to iron of the same nature it was originally. It will then be apparent that barrels composed wholly of steel are altogether unsuitable for shot guns. This fallacy of so manufacturing shot barrels has been proved over and over again.

In twisting the rods care is taken to keep the edges of the iron and steel strips to the outside, for it is the twisting of the different metals that gives the various figures in the finished barrel. The steel being hard resists the acids, and retains a white or light brown hue, whilst the iron, or softer metal, is so acted upon by the acid as to be changed into a dark brown or black colour. The manner in which the strips are laid and welded together will be found in Fig. 183.

The best barrels must be made from the best, and therefore from the *most expensive, steel and iron that can be produced.* Owing to the difficulty of obtaining good scrap iron and steel—the importation of old horse-nails from the Continent has long been discontinued—it has been found necessary to manufacture the gun-barrel iron from new metal. The rods of metal as now prepared are extremely tenacious, and capable of withstanding an enormous strain. The average strength of rod $\frac{6}{16}$ by $\frac{5}{16}$ by 12 inches long, containing 1·40625 cubic inches of iron, is equal to a tension of over 16,000 lbs.

It takes 18 lbs. of prepared gun-iron to weld an ordinary pair of 12-gauge barrels, which, when finished, weigh, with the ribs, lumps, and loops, but little over 4 lbs. After bearing in mind this fact, and considering the great expense and loss of expensive steel and iron attending the manufacture of the metal, and the cost of welding of

best barrels, it will no longer be a matter of wonderment that best guns are expensive to produce.

We have given sufficient information to enable a person to judge of the great labour, care, and scientific knowledge required to produce a satisfactory amalgamation of iron and steel for the manufacture of the various kinds of gun-barrels; but, owing to the details being considered trade secrets, we do not think it would be just to the manufacturers to divulge the results of their many experiments, by which alone they have been able to produce iron capable of being worked into faultless barrels.

The numberless welds and numerous processes necessary to produce a twisted barrel present occasions for the introduction of foreign matter, and thus cause a faulty barrel. Anything that will simplify the processes, or reduce the number of welds by lessening the risk, tends to the production of more perfect barrels. Our efforts have been directed to this end; and, although not as yet entirely successful, we have produced a clear, figured, weldless barrel, that is perfection for rifles, and suitable also for shot-guns of best quality.

BARREL WELDING.

The iron for the manufacture of gun-barrels is supplied by the iron-makers in square rods of various thicknesses for best barrels, and in flat rods for plain twist or scelp barrels. We give an illustration, on the opposite page, of the barrel welding shop at St. Mary's Works, Birmingham, and will now endeavour to describe the processes of barrel welding.

The square rods of prepared iron are first twisted to give the Damascus figure. The rods are about four feet long, and are placed in the forge fire until about eighteen inches of the rod is brought to a red heat, when one end is thrust into a square hole in a block made fast to a frame, and the other end fixed into a movable head at the other end of the frame; a rotary motion is then given to the movable head by means of a winch-handle and cog-wheels; the rod, being square, cannot turn round with the head, so is twisted in itself. The rod is carefully watched whilst twisting, and should one part commence to twist more rapidly than another, a man is ready with a pair of tongs to hold that part of the rod, so that it is prevented from twisting. This process is repeated

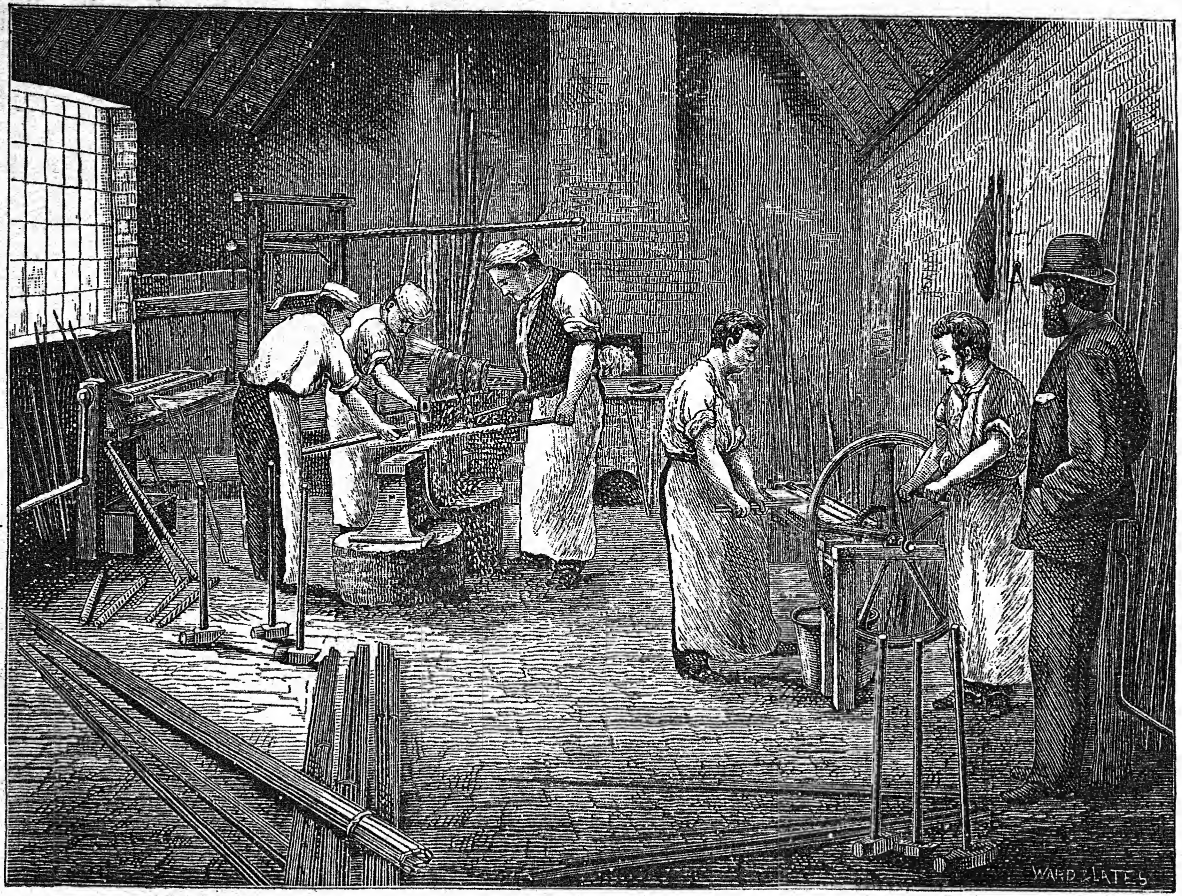


Fig. 182.—Gun-Barrel Welding at St. Mary's Works.

until the whole rod is perfectly twisted, and a regular figure in the barrel insured.

When finished twisting, the rod will be round, except the squares at each end where held in the block and head, and the four feet rod will have become shortened to about three feet three inches, and have about eight turns to the inch. It is this twisting of the rods that makes the difference between a best barrel and a common one. All Damascus barrels must be made of twisted rods, whilst plain twist or scelp barrels are made from plain straight rods or ribands. It is the twists in the rods that cause the figure to appear in the barrels, and all iron so twisted is called Damascus—from Damascus, where a similar process was first practised for the manufacture of the far-famed Damascus sword-blades. It gives increased strength and tenacity to the metal by rendering the fibres more dense.

The rod prepared, it is either joined to other rods or coiled and welded into a barrel singly.

The cheapest Damascus barrels (single-iron stub Damascus) are made from a single twisted bar, rolled out into a riband $\frac{7}{8}$ of an inch by $\frac{1}{8}$ for the fore-end of the barrel, and $\frac{7}{8}$ by $\frac{1}{4}$ for the breech-end.

Two-iron stub Damascus barrels are made from two twisted rods, each $\frac{3}{8}$ square, and welded together and rolled into a riband $\frac{5}{8}$ by $\frac{1}{16}$ for the fore-part, and $\frac{5}{8}$ by $\frac{3}{16}$ for the breech-end, with the twisted spirals in opposite directions, as in Fig. 184.

Three-iron stub Damascus barrels are made from three twisted rods, each $\frac{3}{8}$ by $\frac{7}{16}$, and laid and rolled together with the spirals, as shown in Fig. 185; forming a riband of $\frac{1}{2}$ inch by $\frac{7}{16}$ for the breech-ends, and $\frac{1}{2}$ an inch by $\frac{3}{16}$ for the muzzle-piece.

Laminated steel barrels are twisted, and the rods welded in the same manner as the stub Damascus, but the rods are composed of superior metal containing a larger per-centage of steel.

In laminated steel and stub Damascus barrels it is not usual to use more than three rods in their manufacture. Fine Damascus barrels, as manufactured by the Belgians, are occasionally made from four or six rods together, but three is sufficient to give a very fine figure.

The true English Damascus barrels are manufactured usually from three twisted rods prepared in the same way as described for the manu-

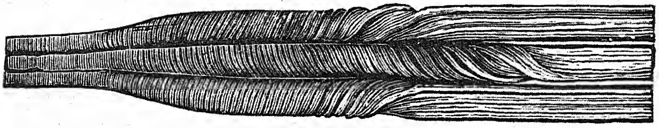


Fig. 183.—Gun-Barrel Iron, Twisted, and laid into a Riband.

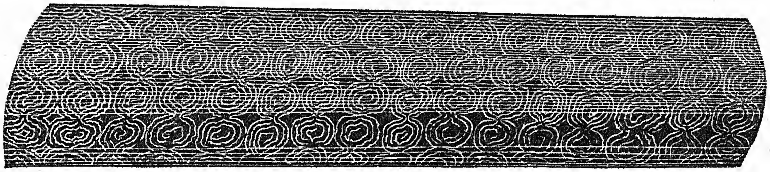


Fig. 184.—Two-Iron Damascus Barrel.

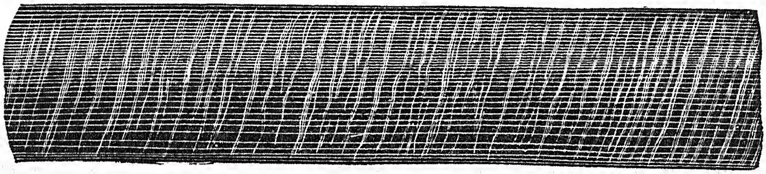


Fig. 184a.—Scelp Gun-Barrel.

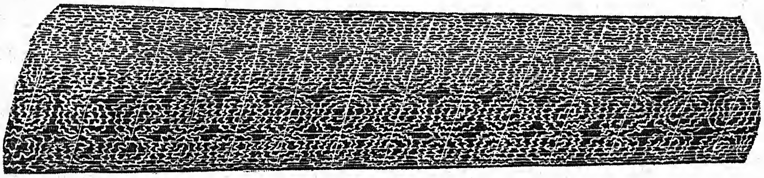


Fig. 185.—Three-Iron-Steel Damascus Barrel.

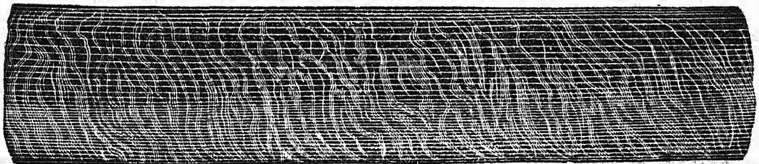


Fig. 185a.—Single-Iron Damascus Barrel.

facture of stub Damascus, but the rods are composed of a superior iron of a finer quality in the figure or streaks, which have to be very decided, white and black, as described in iron-making.

"Crolle" or silver steel Damascus barrels are made up in either three or four rods to the riband. They possess a large per-centage of steel, and have a curly and well-defined figure; they possess a high degree of hardness and elasticity, but require the greatest care in welding.

The rods having been twisted, and the required number welded together, they are sent to the iron mill and rolled at a red heat into ribands, which have both edges bevelled the same way. There are usually two ribands required for each barrel, one riband or strip to form the breech-end, and another, slightly thinner, to form the fore or muzzle part of the barrel.

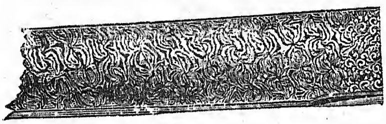


Fig. 186.—Silver-Steel Damascus Barrel.

Upon receiving the ribands of twisted iron, the welder first proceeds to twist them into a spiral form. This is done upon a machine of simple construction, and consists simply of two iron bars, one fixed and the other loose; in the latter there is a notch or slot to receive one end of the riband. When inserted, the bar is turned round by a winch-handle. The fixed bar prevents the riband from going round, so that it is bent and twisted over the movable rod like the pieces of leather round a whip-stock. The loose bar is unshipped, the spiral removed, and the same process repeated with another riband.

The ribands are usually twisted cold, but the breech-ends, if heavy, have to be brought to a red heat before it is possible to twist them, no cogs being used. When very heavy barrels are required, three ribands are used—one for the breech-end, one for the centre, and one for the muzzle piece.

The ends of the ribands, after being twisted into spirals, are drawn out taper and coiled round with the spiral until the extremity is lost, as shown in Fig. 187, which represents a coiled breech-piece of Damascus iron.

The coiled riband is then heated, a steel mandril inserted in the muzzle end, and the coil is then well hammered. Three men are

required—one to hold and turn the coil upon the grooved anvil, and two to strike. The foreman, or the one who holds the coil, has also a small hammer with which he strikes the coil, to show the others in which place to strike. When taken from the fire the coil is first beaten upon an iron plate fixed in the floor, and the end opened upon a swage, or the peam of the anvil, to admit of the mandril being inserted.

When the muzzle or fore-coil has been heated, jumped up, and hammered until thoroughly welded, the breech-end or coil, usually about six inches long, is joined to it. The breech-coil is first welded in the same manner, and a piece is cut out of each coil; the two ribands are welded together and the two coils are joined into one, and form a barrel.

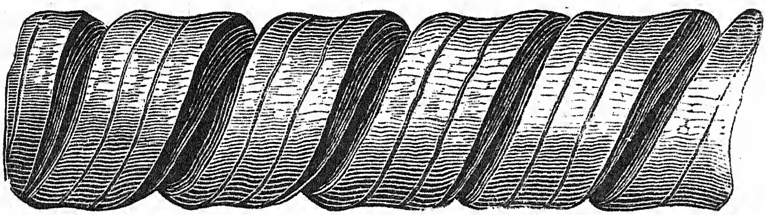


Fig. 187.—Portion of Gun-barrel Coil.

The two coils being joined, and all the welds made perfect, the barrels are heated, and the surplus metal removed with a float; the barrels are then hammered until they are black or nearly cold, which finishes the process.

This hammering greatly increases the density and tenacity of the metal, and the wear of the barrel depends in a great measure upon its being properly performed.

When the barrels are for breech-loaders, the flats are formed on the undersides of the breech-ends, and when for muzzle-loaders the bars are forged on. If an octagon barrel is required it is forged in this form upon a properly-shaped anvil; and in rifles the barrels are welded from thicker ribands, and welded upon smaller mandrils.

Ribs are forged from rods twisted in the same manner as described for the manufacture of Damascus iron. They are then forged to the required shape upon a grooved anvil. Plain iron ribs are used for very

common guns, in which case they are rolled for the gun to the required shape.

We have now described the process of barrel welding, as practised at St. Mary's Works under our personal supervision. The same method is generally followed by the other barrel-makers of Birmingham and neighbourhood, who manufacture for the London and country trade.

The London and provincial makers depend upon Birmingham and Liège for their supply of barrels; the latter we have always opposed, on account of the soft material of which they are composed.

We will now proceed to describe the method practised in Birmingham for the manufacture of medium and common grade barrels, and without which this work would be incomplete.

The iron is twisted in much the same way as that already described, but steam-power is used to turn the winch instead of hand-power. The forge-fires are blown by a steam fan, instead of the old-fashioned bellows, and the welding is done by one man instead of three. This is accomplished by having a tilt hammer close to the forge regulated to give sharp, quick, short blows, and capable of being thrown in and out of gear with the foot. The welder is also provided with an anvil, swages, mandrils, &c. When he removes the coil from the fire, he has only to knock in a mandril, straighten the coil on the anvil, jump it close by striking it on the floor in the usual manner, and place it under the tilt, re-heating the coil, repeating the process until the barrel is properly finished. The appearance of barrels so welded is not so good as that of those hammered by hand, but they are strong and sound, and, on account of less care and labour being bestowed on their production, they are cheaper than hand-forged barrels.

The latest method of making the plainer twist barrels is to treat the iron for twisting and the coils in a furnace instead of a breeze fire. The theory is that the metal is less liable to be burned, the heat being uniform, and freedom from greys and faulty welds. Experience does not fully bear out the theory. Possibly more can yet be done in this line towards producing a perfectly welded and clear barrel. At present it is usual to pass the barrel through rolls immediately they are "jumped up" after leaving the furnace.

FOREIGN OR BELGIAN BARRELS.

In the manufacture of gun-barrels the Belgians have long been famous, especially for Damascus barrels. Their most ornamental barrels, in which the Damascus figure is very minute, are made in the following manner:—

The welders take thirty-two alternate bars of iron and steel, and have them rolled into a sheet $\frac{3}{16}$th of an inch in thickness; the sheet is then split by a machine into square rods. These rods are then twisted

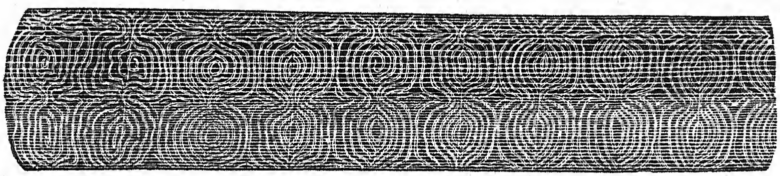


Fig. 188.—Two-Iron or "Boston" Damascus Barrel.

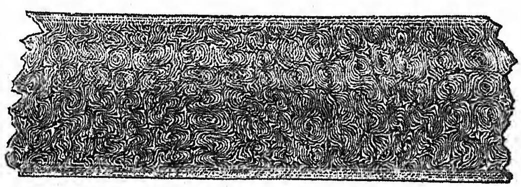


Fig. 189.—Finest Belgian or Six-Stripe Damascus Barr

as already described, but to such an extent that the threads resemble a very fine screw, there not unfrequently being eighteen turns to the inch.

Six of these rods are rolled together to make a riband instead of three, as is usual with us, and the result is a figure so extremely fine that it appears no larger than the finest needle. (See Fig. 189).

These barrels, although a fine piece of workmanship, are not able to resist so great a strain as ordinary Damascus iron barrels; for as twisting the barrel to make English Damascus barrels strengthens and increases the

tenacity of the metal, so the over-twisting practised by the Belgians rends apart the fibres of the iron, and the rods are weakened thereby in the same manner that a hemp rope is weakened and rendered useless by over-twisting.

These barrels, as also all the better quality Damascus barrels, are welded upon a "chemise," or plain iron lining, which is bored out after the barrels are welded, thus leaving the barrels of Damascus iron alone. The old plan of plating a thin coat of Damascus iron upon a plain iron barrel has been almost abandoned by barrel-makers, except for very heavy duck-guns or rifles, which are frequently welded of scelp or plain twist iron first, and coated with Damascus iron.

We consider Belgian barrels to be far inferior to those made in Birmingham, on account of the soft material from which they are made. There being but very little steel in their composition, the figure is frequently obtained by using two different preparations of iron, instead of iron and steel. These barrels can be made to shoot well, but they will not retain their shooting powers for any length of time. They are not at all adapted for full choke-bores, as the metal, not being sufficiently tenacious to stand the increased strain at the choke, causes the barrel to bulge at that part. We give here two illustrations of the Belgian barrels commonly used by the London and country makers.

The barrel-welders of Belgium are chiefly located at or near Liège. The very best barrel-makers who manufacture for the London, Berlin, and Vienna markets are to be found at La Chafontaine or Nessonvaux, both places a few miles from Liège. Their method of welding is much the same as that practised by the best English welders, but they work at a smaller forge, and instead of breeze use a mixture of coal-dust and clay. The fires being much smaller, the barrels are heated only a few inches at a time, so that greater labour has to be bestowed upon their manufacture.

The greatest care is taken to keep the anvils and tools perfectly clean and free from scale, so that no foreign matter can get between the coils and thus affect the soundness of the welds.

The other Continental places where good gun-barrels are forged are St. Etienne in France, Brescia in northern Italy, and Suhl in Prussia. They follow, however, the same method as that practised by the

Belgians, and imitate as nearly as possible the patterns of English and Belgian welders.

BARREL-BORING.

The boring of gun-barrels may be divided into three classes: Rough-boring, Fine-boring, and Lapping, or lead polishing.

Rough-boring is effected upon a bench, similar to the one illustrated in our description of fine-boring.

The head for carrying the bit revolves rapidly, about 300 revolutions per minute. The bit is a square rod of steel, slightly tapered at the point, and about 5 feet long.

The extremity of the bit is flattened out, and has a hole to receive the pin that fixes it in the spindle head.

The barrels are held in a carriage, which traverses the whole length of the bench. An iron rack is fixed upon the bench, and a small crowbar being engaged in the rack is used to force the carriage towards the bit. When the barrels are being bored, the barrel to be bored is fixed in the carriage, a bit of suitable size selected, and, by means of the rack and crow-bar, the bit is forced right through the barrel. A bit of larger dimensions is then introduced and passed through, and others of still larger dimensions, until the whole of the scales are removed and the barrel is bored to the required size. Should the scales not be bored out, the barrel is returned to the welder, who heats it and hammers down that portion of the barrel, when it is re-bored. During the process of rough-boring, a stream of cold water is kept playing on the barrel to keep it cool. This branch does not require skilled labour, but it is entirely otherwise with fine-boring and setting, or straightening, which require great care and judgment.

Until the present century the art of straightening gun-barrels was not well understood.

SETTING OR STRAIGHTENING GUN-BARRELS.

Previous to 1795 all gun-barrels were comparatively crooked, there being no reliable method of ascertaining when the barrels were straight.

The usual way was to look along the outside, and set them as straight as possible from the *outside*. About 1795, however, a barrel-maker of Birmingham, named Parsons, introduced a plan of straightening barrels from the inside. His method consisted in stretching a string or fine wire inside the barrel from end to end, and touching the side at each end. He then hammered that side of the barrel until it touched all along the string. The string was then moved to the opposite side of the barrel, and if it touched all along the string it was straight. The same process was repeated on the top and bottom sides of the barrel. A few years afterwards, the method of shading the insides of gun-barrels was discovered. This simple and reliable plan has since been universally adopted as the standard.

To determine if a barrel is straight, the setter holds it a few inches from his eye with one end pointing towards the top of a high shop-window. The rays of light being horizontal, and the barrel at a slight angle, it shows about half the bore in shadow; if the shade is irregular the barrel is crooked; if the shade is perfectly level from breech to muzzle, on the barrel being turned round, the barrel must be a perfectly straight one. To straighten a barrel, the setter should note where the swellings appear on the shade, and strike the barrel in that place with a hammer upon a hollow anvil. Some setters straighten from the indentations in the shade, in which case the barrel must be struck on the opposite side to the one shown on the indentation in the shade. A skilful setter can make a barrel perfectly straight with a few taps of the hammer. The fine-boring bit having a perfectly straight cutting edge of eighteen or twenty inches, tends in a great measure to set the barrel tolerably straight. The barrel being thin the greater part of its length, it gives considerably to the bit. A simple expedient for detecting the straightness of a gun-barrel is as follows:—Place the barrel at a slight angle upon two fixed stands; take a small frame and cover with tissue-paper, and place the same at about six feet distance from the muzzle of barrel with a light behind it; point the barrel towards the top edge of frame, and a dark shade will at once be seen upon the bottom side of the barrel.

Turn the barrel round upon the stands, and if the shade keeps a perfectly true edge, the barrel is straight. Place at any point between the

stands, about three inches below the barrel, a lighted lamp or candle. This will cause the barrel to bend, and an irregularity in the shade line will be immediately observed; upon the light being removed, the barrel will return to its original form, or very nearly so. If the barrel is of steel (as a rifle-barrel), and not twisted, it may be experimented upon with the candle four or five times, and the barrel will return to its original straightness. A twist barrel but very seldom altogether recovers its original form after having been drawn by the heat. This proves that barrels should never be heated to a red-heat after the boring is finished. It is a common practice with foreign makers to braze their barrels together from end to end. This is most injurious, as the barrels cannot be perfectly straight when so treated. The first order for Government rifles was received in Birmingham about 1816, and at that time setting or straightening was so little known that many of the barrels were far from being straight.

The importance of this invention cannot be overrated, as without it it would be impossible to obtain the extraordinary precision of the match rifles of England and America.

Upon the examination of a fine public collection of ancient small-arms by a practical man, it was found that out of the whole collection there was but one barrel that was, or had been, anything approaching to perfect straightness; whilst the greater number deviated greatly from the straight line. The arms themselves are marvels of mechanical ingenuity and skill, and are the work of the leading and most renowned gunmakers of Europe, and finished in the most elaborate and artistic style, proving that they had been veritable *armes de luxe*.

The fine-boring is performed upon a similar bench to the one used for rough-boring. The bit, however, revolves at scarcely half the speed of the rough-boring bit, and cuts on one edge only. The bit is shown in Fig. 191. A weight and chain are used, instead of the crowbar and rack, to force the barrel to the bit. The bit is made to fit the barrel by means of a spill of wood, packed with strips of paper called liners, between the wooden spill and the bit (Fig. 191). Thus, by using more packing or a larger spill, the same bit may be used to bore several sizes out of a barrel. Only one sharp edge is ground upon the bit, one being rounded and acting as a burnisher; the other two edges are pre-

vented from coming into contact with the barrel by the packing, which is kept on the bit by means of a ferule that works off as the bit enters the barrel. All barrels, choke and cylinder, go through this process when in the "tube" state. When the boring and straightening is completed, the tubes or barrels are placed in a lathe, and the extreme breech-ends and

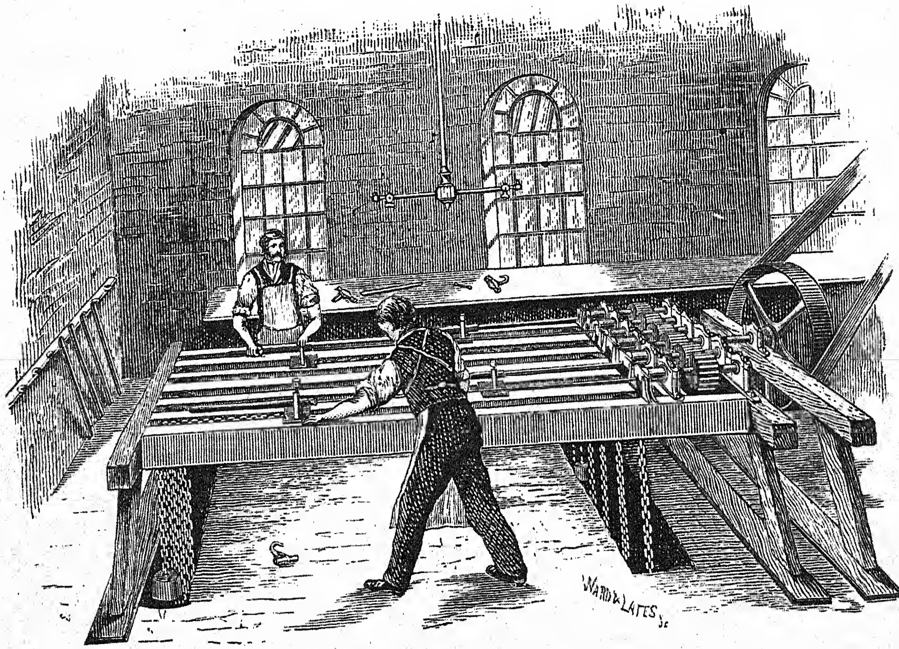


Fig. 190.—Barrel-Boring at St. Mary's Works.

muzzle turned to the proper thickness. They are then taken to the grinding-shop, where the barrels are ground down upon a stone to the turning marks and other gauges. Most barrels are ground upon large rough stones—one rough and the other fine grit. The stones are kept rough by hacking or chipping the grinding surface with an adze. These stones revolve at a great speed, about 650 revolutions per minute.

It is, indeed, surprising to see the great skill which experienced

grinders have acquired. Many times we have seen barrels from the grindstone put into the lathe, and found almost as true as if they had been turned.

The grinders have a method of allowing the barrel to revolve in their hands, at half the rate of the stone, and by this means they grind them so fine that many would be puzzled to say whether they had been

Fig. 191.—The Fine-Boring Bit and Packing.

turned or ground. The squares of a rifle-barrel are ground as perfect an octagon as the eye could assist in forming. The tubes, after they have been smoothed lengthways to take out the marks of the stone, and a breech-plug screwed in, are ready for provisional proof. The proof charges and method of proof will be found under the head of Proof-house.

The process of grinding is the only branch of the gun-trade that can be considered dangerous. The stones sometimes split into pieces, and when this happens it is rarely that the grinder escapes, and several have been killed during the last five years.

CHOKE-BORING.

Barrels intended for choking are left two sizes smaller than the cartridges they are intended for—that is to say, the 12-bores are left 14-bore,—16-bore, 18-, and the barrels are bored up within three inches of the muzzle with a fine-boring bit, using a spill and liners as already described. The bit, however, is not allowed to pass right through the barrel, but is withdrawn before reaching the muzzle. This is a very tedious process, it being a difficult matter to get the metal from that part of the barrel nearest the muzzle. When sufficient metal has been taken from the barrel it is removed to another bench, where another bit is inserted revolving at a slower speed. This bit is of a different nature to the boring bit, it being chamfered off towards the point in order to shape the cone of the choke and the flat, between the top of the choke and the muzzle of the barrel. By the use of this tool the choke is kept perfectly

straight and true with the barrel, but it is not used by all makers, who shape the choke instead with an ordinary taper boring bit. Most of the barrels are lapped or polished with a lead and emery upon another bench. The lap consists of an iron rod, around which is cast a leaden case of the same size as the diameter of the barrel to be lapped. The lead is kept constantly covered with a mixture of emery and oil.

This lap is fixed into a head revolving 650 times a minute. The barrel is fixed on a carriage upon a lathe bed, and the lap having been inserted, and set revolving, the barrel is moved backwards and forwards along the lap, in order to perfectly level the inside of the barrel, and remove any slight inequalities that may have been occasioned by irregularities while boring, and also to polish it as fine as possible, which is necessary if first-class regular shooting is to be obtained. It also renders the barrel more easy to clean, and less liable to lead or foul. This process requires very great care, owing to the great speed at which the lap revolves. The barrels being bored very thin at the muzzles are likely to bend, or the rib to be loosened or twisted; so, during this process they are kept cool by the frequent application of cold water.

BARREL-FILING.

After the barrels are provisionally proved, they are looked over to see that they are perfectly clear from greys. They are also again straightened if they require it. Flats are then filed upon the inside of each tube at the breech-end, to cause the barrels to lie closer together. The steel bottom lump is then dovetailed in, as Fig. 192, and brazed for about three

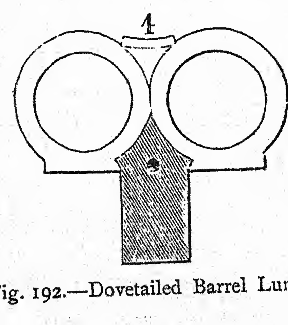


Fig. 192.—Dovetailed Barrel Lump.

inches up the barrel from the breech-ends. When the barrels are wanted for wedge-fast guns, the top lump or extension rib is brazed on at the same time. The space between the barrels is packed at intervals with pieces of tin. The ribs are then soft-soldered on, and the loop fitted in. The barrels are struck up from end to end with flat strikers or oblong files, which are used like joiners' planes, and serve to take off all inequalities on the barrels and ribs.

In a well-filed pair of barrels the rib will be seen to be level, straight, and nicely taper, and the barrels round and even, and free from flats.

The barrels then go into the machine-shop to be prepared for fitting them into the breech-action.

MACHINING.

It is only of late years that steam machinery has been considered necessary for the manufacture of sporting breech-actions, and even now those few London and country gunmakers who manufacture their own breech-actions are, with a very few exceptions, under the necessity of labouring with the slow and old-fashioned foot lathe. Those gunmakers, however, who have to produce first-rate weapons at a moderate price, as well as high-class hammerless guns, are obliged to provide themselves with machinery sufficient to carry on a light engineering business, and most of them are able to manufacture their own machinery upon the premises.

By adopting steam machinery, and the division of labour, we find it not only possible to reduce cost of manufacture, but the work is done much better than if one man did three or four branches. The work done in the machine-shop we will now endeavour to describe.

The barrels are placed into a lathe for chambering, the tool revolving very slowly, about 120 revolutions per minute. The barrel is slowly forced towards the lathe head by the screw centre, and soap-suds are continually kept running upon the tool, to assist the cutting and keep the tool clean. The barrels are first rough-chambered, the extractors fitted, and then finished chambering. The roughing tool is generally half round, which cuts on one side only. The finishing tool cuts very fine, and has generally three or five cutting edges. The barrel, when chambered, is

taken to a milling machine and the recess for the extractor cut, the hole for the leg having been drilled in the steel lump before brazing it to the barrels.

The steel lump is planed on each side to gauges, so that it may be in the centre of the barrels, and a more uniform thickness ensured.

The breech-actions worked in this shop consist of forgings for the body or breech-action proper, the fore-end, and, when double-grip actions, the lever.

The milling machine, which does most of the work to the breech-actions, resembles a lathe head upon a short bed, in front of which is a slide rest, capable of being moved vertically as well as horizontally. The body is fixed in a holding block, and a cut taken down one side. This side then serves as a basis from which the body may be machined square and true. By moving the handles right or left, forward or backward, up or down, the body may be planed all over, and a much truer form obtained than if done by a file.

The lock holes, to receive the mainsprings, can also be cut, the slots for lump drilled; the joint, or hinge-pin on which the barrel turns, put in perfectly true, and the fore-end joint shaped, a half circle of which the joint-pin is the centre.

The hollow joint in the fore-end is cut by a tool running between centres in a lathe, and is made to coincide with the joint formed on breech-action. The bolt-hole, or slot in the body for the under-bolt, is generally drilled in a lathe. Besides the above, the extractors, hinge-pins, strikers, &c., are turned in this shop, and various tools and cutters made; therefore it is necessary that the whole shop be managed by a clever engineer and tool-maker.

The wedge-fast hammerless guns are treated in the same manner, but the slots for the lock-work are cut in the bottom of the body and block of the standing-breech.

The hinge-pin also has to be left solid in the action, instead of being screwed in, as is the case with other actions.

A plate fits over the bottom of the body, covering slots, &c., when the gun is finished. The accompanying engraving shows the body as left from the machine.

BREECH-ACTION FILING.

This branch comprises the fitting of the breech-actions, fore-end, lock-work, &c., to the barrels. It may be classified under the heads of jointing, filing up, and fitting lever work.

The jointer takes the body and fore-end of breech-action in machined state, as Fig. 193, and first proceeds to square the holes in the body, and drift them out to the proper size. He next files the lump, or lumps, on the barrels to the gauge of the holes in the body, and gradually eases the body on to the barrels, by smooth-filing the lumps on the barrels. The

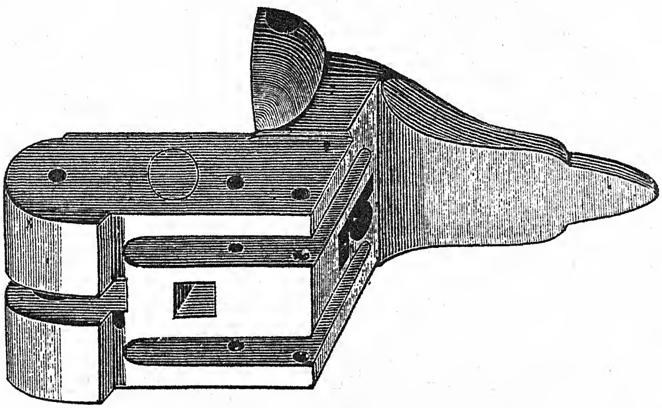


Fig. 193.—Machined Body of Breech-Action.

extractor is then fitted into the machined recess, and the face or end of the barrels squared, the joint or hinge-pin is inserted, and the hook on the bottom lump cut for it; and the breech-ends of the barrels, by blacking and smoothing (which has to be repeated many times) brought to fit closely, and bear hard against the face of the standing-breech, and the flats of the barrels firmly bedded upon the bottom of the breech-actions. The smoking, or blacking and easing, have to be repeated until every surface fits evenly and closely against the other, and very careful and skilful workmanship is necessary in this branch to ensure perfect fitting. Unless this branch is well done, and the holding-down bolts well fit, the breech-

action will wear shaky with very little use. The jointer also prepares the hole for the under-bolt in top-lever guns, and in double-grip actions he fits the lever. In jointing the Anson & Deeley hammerless guns, the hinge or joint-pin being solid with the body of breech-action, the process of bedding down the barrels, and bringing them to bear against the face of the standing-breech have to be combined. The barrels are first hooked on the solid hinge-joint, and carefully eased down against the breech together.

It will be seen from the drawing that the breech-ends of the barrels

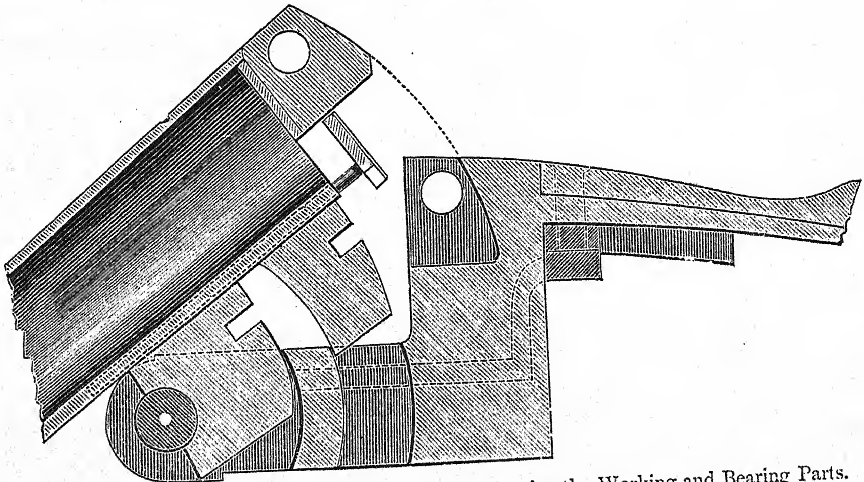


Fig. 194.—Section of Hammerless Breech-Action, showing the Working and Bearing Parts.

describe the portion of a circle in opening and shutting, and that the back portion of the bottom steel lump, being filed on the circle, also describes the part of a circle, and the slot in the body being shaped to correspond with the circle on the lumps fitting against the circle in the body, causes part of the strain of the discharge to be removed from the hinge-pin, and distributed over the body of breech-action. The extension rib must be accurately fitted, yet made to work in and out with perfect freedom. It is the proper attention to these and other points that adds so greatly to the cost of guns.

From the above engraving (Fig. 194) it will be seen that the extractor

is made in one piece, the leg only being round. The extractor is kept in place by a groove in the extension rib; a small rounded projection being left at the top of the extractor, it fits into and works in the circular groove in the extension rib.

We invented this extractor some years ago, and it is the best and most serviceable form of extractor which we are acquainted with, and has been largely applied in the gun trade to sporting guns with extension ribs.

FILING UP.

The first thing done in this branch is to drill and plug out the nipple and striker holes (if the gun is not hammerless). The striker holes are first drilled to a centre, marked by a tool fixed in the chamber. The hole is then enlarged to admit of the shoulder of the striker or exploding-pin working freely, and plugged out and tapped, to admit of the nipples being screwed in.

The locks and furniture are then fitted, the fences or scroll round the nipples formed, and the body, fore-end, &c., filed into shape, and smooth-filed. The gun is then ready for the top-lever work to be fitted. In hammerless guns the routine is slightly different. The bodies are first roughly shaped, they then go to the lock filer and have the inside work, or lock work, fitted to them, the furniture, &c., fitted, and triggers and pull-off adjusted. The action is then sent back to the filer, who finishes shaping it, and smooth-filing, and gets it ready for fitting the top-lever work.

FITTING UP.

In the treble-wedge-fast and top-lever guns this branch is considerably subdivided. One man usually fits the bottom-bolt, another fits the lever, another prepares the tumbler-springs, pins, &c., the whole being put together and adjusted by the master-man of the shop. Care has to be taken in this branch to so arrange the work that the top and bottom bolt commence to travel together, and immediately on the lever being moved. The bites or grip upon the bottom and top lumps must also be good, and the bolts fitted evenly and closely in the slots prepared for them, so as to equalise the strain as much as possible. A crooked and consequently badly fitting bottom-bolt is more apt to break than one

properly fitted, as it would have to stand the whole strain of the explosion, whereas, in a well-fitted bolt the strain would be borne by the slot in the breech-action as well as by the bolt itself.

FURNITURE FILING.

Gun furniture usually consists of trigger-plates, triggers, guards, and heel-plates and tail-pipes.

The forgings of the furniture are all made by one man, who gives all his time to furniture forging.

Common furniture is made from malleable cast iron. It is the business of the furniture filer to fit the triggers and guard to the trigger-plate, file them up to the proper shape, and to make the bow of the guard lie uniform, allow sufficient play to the triggers, and leave sufficient room between them for the finger, file up and shape the heel-plate and tail-pipe.

The furniture filer also fits the detant work for the hair-triggers, when required. Hair-triggers are now but very seldom made, and are considered very old-fashioned. The mechanism consists of a mainspring, which is set into a bent by the trigger being pushed forward; when the trigger is touched the spring is released, and strikes the scear of the lock a sharp blow, and thus releases the tumbler.

The furniture filer also fits safety and scroll guard when required, but these are fast falling into disuse.

Safety guards have long been considered unnecessary, and, owing to their frequently getting out of order, were more often elements of danger than security.

LOCK FILING.

The various parts of a gun-lock are forged by experienced hands from the best iron and steel, and handed to the lock filer, who first squares the lock-plates, and drills the holes from a pattern laid on the plate. The tumbler shank and pivot is turned or ground between two cutters, which makes the pivot and shank central with each other, and at perfect right angles to the body of the tumbler. The bridle is then filed up and fixed, the scear placed on and shaped, and the swivel fitted to the tumbler. The mainspring and scear spring have then to be shaped, filed to the requisite thickness and strength, fitted upon the lock-

plate, and then hardened and tempered. The bents are then cut in the tumbler with a small saw, and finished with files and smoothes, until the scear works with as little friction and rubbing as possible. A very

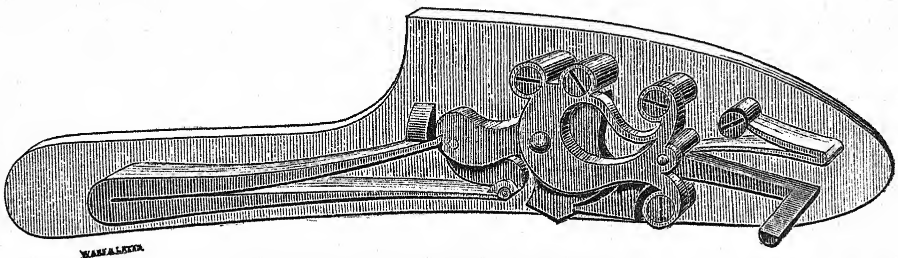


Fig. 195.—Modern Rebounding Gun-Lock.

old smooth file, worn almost to a burnisher, is used to finish the bents and bearings of the lock.

We show in Fig. 195 a modern rebounding gun-lock altogether, and

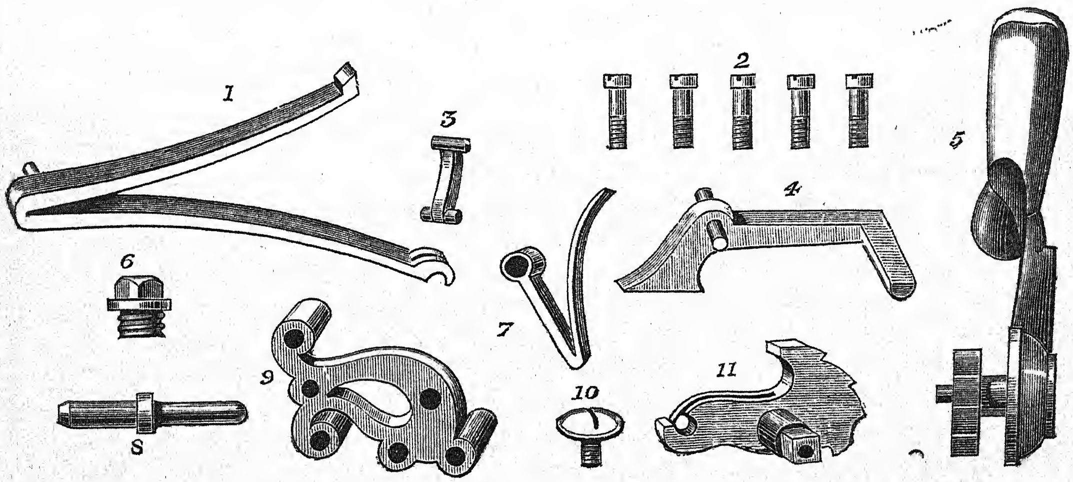


Fig. 196.—Pieces of Modern Gun-Lock.

in Fig. 196 the same taken to pieces, with the exploding mechanism included.

In Fig. 196, 1, is the mainspring; 2, the bridle and scear spring pins;

3, the swivel; 4, the scear; 5, the hammer affixed to tumbler shank, showing an end elevation of tumbler; 6, is the nipple; and 8, the striker or exploding-pin (the two latter are not inside the lock, but are fixed into break-off of breech-action); 7, is the scear spring; 9, the bridle; 10, the tumbler pin; and 11, the tumbler (side view). The bridle, hammer, and lock-plate only are of iron, the remaining parts being of steel. The springs are forged in long flat strips, and are bent into the V shape by the filers.

In the Anson and Deeley hammerless guns there are no lock-plates, the work is fitted into slots, machined underneath the body of breech-action, as shown in Fig. 193.

The lock-work itself is shown in Fig. 197. 1, is the mainspring; 2, the lifting or cocking lever; 3, the tumbler striker and exploding-pin; 4, the scear spring; 6, the scear; 7 and 8, are the pivot pins passing through the body on which work the scears and cocking levers; 5, is the pivot on which the tumblers work, and shows an end view of the tumbler in elevation; 9, is the scear spring pin; and 10, a safety bolt for affixing to the gun and bolting the triggers. It will be seen that there are less pieces in the Anson and Deeley lock, and, compared with the ordinary lock, they are all very much broader and stronger.

In W. W. Greener's latest hammerless lock the cocking dog, 2, is dispensed with, and a new and more simple method of cocking employed, all fully described under the heading "Hammerless Guns."

The great point in all this kind of work (action, lock and furniture filing) is to file flat and square; proficiency in this art is only acquired after many years' practice, and by those who have been apprenticed to the work while young. It is well known that the Birmingham gun filers are unexcelled by any in their skilful use of the file, and it is certainly extraordinary to see the beautiful shapes and close fitting turned out by them, and it is not too much to say that their work cannot be excelled, if equalled, by any artisan employed in any country at any trade. The above remarks are equally applicable to the gun-lock filers of the Black Country: Darlaston, Wednesbury, and neighbourhood of Wolverhampton, have long been famous for the excellent quality of their locks, and as good locks may still be obtained from there as any the world can produce.

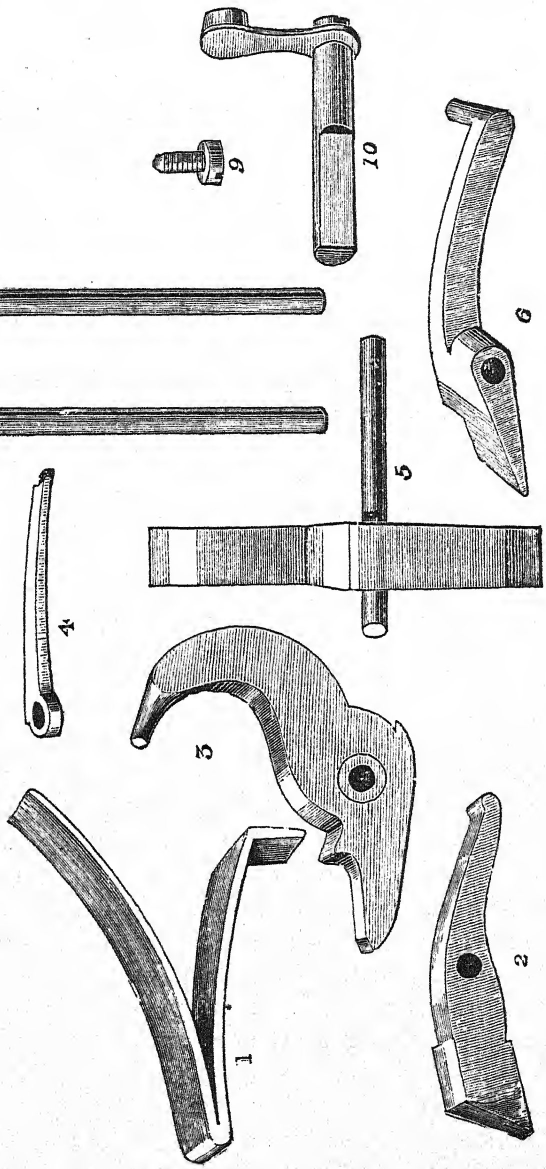


Fig. 197.—Lock-work of the Anson and Deeley Hammerless Gun.

GUN-STOCKS AND STOCKING.

The wood best suited for the stock of a sporting gun is heart walnut. It is necessary to pick the wood carefully, and great judgment is required when marking out the planks of walnut before sawing.

The best stocks are obtained from the veneer makers, who before cutting the veneer reserve the most suitable portion of the tree for gun-stocks. The most beautifully marked stocks are cut from the portion of the tree where the roots and trunk join. The tree, therefore, requires to be grubbed up and planked when in that state. Inferior stocks are cut from the branches; sometimes they are well marked, but they are all liable to warp. The best timber for gun-stocks grows in the centre of France: it is at the same time handsome, light, tough and sound. Spanish and Italian walnut is too heavy for any other than rifle-stocks. Circassian and Turkish walnut is very heavy, and too brittle to stand the rough handling gun-stocks are subjected to. German or Swiss walnut is usually open and cross-grained, but it is frequently used. The English walnut is very handsome and tough, but is usually full of shakes or cracks, therefore unfit for affixing to good guns. American walnut is of far too inferior quality to be available for gun-stocks. Good gun-stocks must be light, handsome, and straight in the grain at the grip and head of the gun, free from shakes or cracks, close-grained, and without galls or soft places. In the best stocks the pattern is decided, and generally the black markings are large. The value of a stock is greatly enhanced by a species of cross pattern, or "fiddle," and stocks with such markings will generally be found to possess great toughness.

It is necessary that the stocks be perfectly dry before working them. To ensure this, the best makers keep them in stock at least a year, and the dealers frequently have them in hand one or two years before offering them for sale. From these facts it will be apparent that really good gun-stocks are difficult to obtain, and they will readily fetch a good price.

Of late years the prices have risen considerably, owing to the increased demand for walnut for veneering purposes, and we believe that very few young trees are being planted compared with the quantity yearly cut down.

Up to the present no other wood has been found that will equal the walnut for gun-stocks. Maple was used some years ago, but has been discontinued. Beech is condemned for all but common work on account of its plainness and weight, and ash on the latter account.

GUN-STOCKING.

The stocker upon receiving the stock first roughs it into shape, or, as it is called, trims it out, with a mallet, chisel, and draw-knife. He next proceeds to fit the breech-action to the stock, first bedding the breech-action firmly against the stock, and then letting in the strap. He adjusts the bend or crook of the gun, and the amount of cast-off, partly by the angle of the joint, and partly by the shape given to the stock in trimming-out. When the required bend has been given to the stock, the gun is sent to the screwer to have the trigger-plate let in and the breech-pin fitted. The stocker then proceeds to let in the locks, or, if hammerless, the scears and tumblers only. The locks are stripped and the plates first let in, put together again, and the wood gradually removed until the lock will go into its place and work perfectly free. The head and grip of the gun is then shaped, and the wood cut away to admit of the top-lever work acting. The stock is then rounded up with a draw-knife and rasp-filed over, the fore-end fitted to the barrel and shaped up, when the gun is again ready for the screwers.

This branch requires a great number of tools—chisels and gouges of different sizes and twists. A large assortment of floats and shovels are also required, to cleanly remove the wood from the locks and fore-end. In Birmingham stocking is the only branch done by one class of men (the gun-stockers) ; in London and country shops the stocker also screws, and sometimes even finishes the gun. This is disadvantageous, as the quantity of tools required by the stocker take up all the convenient space on the bench, and if screwers' and finishers' tools are added much time must necessarily be lost in rummaging for the tools or stepping from the vice to obtain them.

SCREWING AND FINISHING.

The screwer first lets in the trigger-plate of the gun, and fits the breech-pin, taking care that it is so fitted that it draws the breech-action

firmly on to the stock. He receives the gun again when finished stocking, and fits the side pins to keep the locks in their place; hangs the triggers, screws in the guard and fore-end; fits the fore-end and safety-bolts if any, and screws on the heel-plate. The gun is then ready for the percussioner, and the barrels go to be finished in the boring, and smoothed ready for browning. When percussioned, the gun is shot at a target, and altered till it makes the required pattern, which is frequently not arrived at until the barrels have been several times re-bored.

When the shooting has been found correct, the gun is sent to the finisher, who first sees that the bend and length of the gun is correct to the order given, and if he has no old pattern gun, he makes off the stock to bend and trigger jigs according to the given measurements. The cast-off and balance has then to be carefully seen to, and the weight of the gun reduced if required. The balance is a very important item to be looked after, as on it depends in a great measure the handiness and utility of the gun. Two guns may be made exactly alike in length, bend, and cast-off, and yet if the balance is not the same, they will handle as if of different bends.

When the finisher has attended to these points, he has to file up and shape the stock and fore-end, smooth the iron-work, wet, dry, and smooth—or, as it is called, "clanse"—all the wood-work several times, so that the stock will not become rough when wet. The whole gun is then buffed over with a leather buff-stick and pumice-stone and rotten-stone. The chequering is then done, and the gun stripped of all the iron-work, and sent for polishing and engraving. When polished and hardened, the finisher has to put the gun together again and see that all the work lies properly on the wood, and set any piece that may have warped from the heat of the fire, oil and buff up the stock, and the gun is ready for the viewer. Under our system the screwing and finishing is done by one man, who, however, has nothing to do with freeing and smoothing either the breech-action or lock mechanism.

PERCUSSIONING.

In the days of muzzle-loaders the percussioner's branch was a very important one, he having to fit the nipple, chamber the breech, drill and

plug the vent-hole, besides shaping the fences and fitting the cocks. With the introduction of breech-loaders his trade has diminished to fitting the cocks only, and with hammerless guns he has nothing to do.

The hammers or cocks are filed from either forgings or stampings. *a*, Fig. 198, represents a modern pattern central-fire cock-stamping; *b*, is a forging, whilst *c* represents the forging filed up in the neatest and most approved pattern. The stampings are very tough if made from good iron, but the leading gunmakers adhere to forgings for the hammers

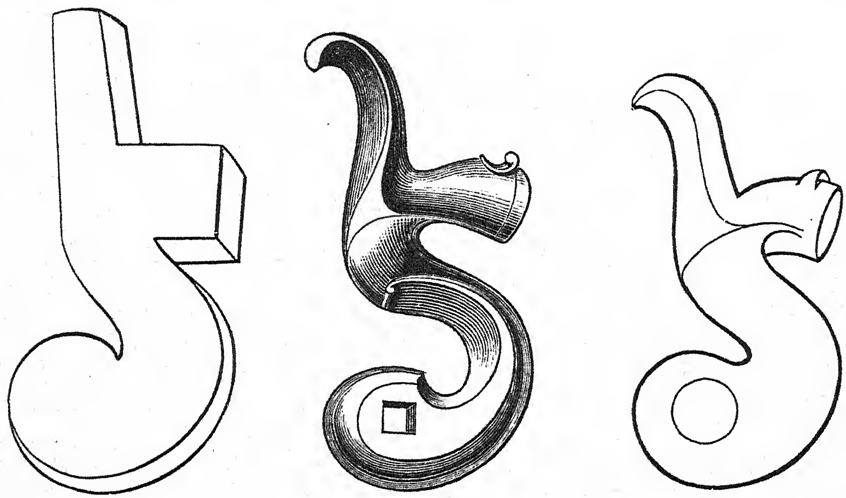


Fig. 198.—Gun Cocks.

of all their best guns. The percussioner, upon receiving the stampings or forgings, first proceeds to drill and square a hole in the hammer to admit shank of tumbler, and fit the hammer upon it; it should fit tightly, to prevent play or liability to fly off; the hole is drifted from round to square by knocking in different-sized drifts, which condenses the iron round the hole, and so prevents the hammer from wearing loose. He then files the noses of the forgings, and adjusts them to strike evenly over the face of the nipple, and proceeds to file up the cocks, the only care being to get them exactly alike, and to see that they stand the same height as each other when the cocks are at both full and half bent.

POLISHING AND HARDENING.

The object of the polisher is to remove from the iron-work of the gun all traces of the file; this is accomplished by polishing the work on emery bobs of various degrees of fineness; all flat parts and the grooves of the hammers are stick-polished, and finished by burnishing with a hard stick burnisher. Some parts of the lock-work are also lapped upon a revolving leaden surface plate, with emery and water, and always for dead-level polishing. The bobs and laps should be driven by steam-power, as is the case in Birmingham. To obtain good results they should make about 2,500 revolutions per minute. In London and country gun-shops the bobs are run upon a foot-lathe. All iron-work intended for blueing is burnished over after it is polished; this tends to close the grain of the iron, as well as giving a deeper colour and gloss to the article when blued. The polishing bob consists of a wooden wheel or disc from 10 to 15 inches in diameter, around which is glued a *tuyere* of buff leather; the *tuyere* is coated with emery powder, also glued; the buffs require the emery coating to be frequently renewed. A number of bobs of various degrees of fineness and coarseness are kept at hand, so that they may be changed instantaneously. When polished, all work goes to be engraved; after the work is engraved, it is case-hardened or blued. The body, fore-end, hammers, triggers and lock-plates, bridles, triggers, escutcheons, and all the screws are hardened, and also the lever, if of iron, which is always the case in the double-grip Lefaucheux action.

The work to be hardened is placed in a cast-iron pot with animal charcoal (made by parching bone-dust), which must entirely cover all the work. The pot is then placed in a bright coal fire, where it remains till the whole is of a worm red. The fire must be a slow one, and the work will require to remain in from 1 to 1½ hours, according to the body of the material to be hardened. A practical hardener can tell by looking into it whether it is ready to come out. When taken out of the fire, the work is plunged into cold water. The iron when at a red heat absorbs the carbon, which causes the surface to become perfectly hard after being suddenly cooled, and also gives a nice mottled colour to the iron. The hardening does not extend beneath the surface, so that it is possible to bend and set the iron as though it were altogether soft. In Birmingham, where bone-

turning is a considerable industry, bone-dust can be easily obtained in sufficient quantities, but in the country and abroad, whenever it is found necessary to case-harden, and bone-dust is not to be obtained, burnt leather is a good substitute, and old shoes are saved for this purpose. Some work is case-hardened by plunging when at a red heat into a solution of prussiate of potass, but work so hardened will be found of a dead grey hue, and wanting the fine mottled colours so much admired. The blue colour is obtained by heating the work in a pan of pounded vegetable charcoal. It is necessary that the charcoal be very fine, but any amateur may blue by placing the pan of charcoal upon a fire, and burying the work to be blued in it. The work must be removed occasionally, and rubbed with tow and powdered chalk to remove any grease, and keep a fine gloss upon the work.

The work will change colour repeatedly; it will first obtain a pale straw-colour, afterwards a light blue, a purple, a dark blue, a red, a white, and lastly a dark deep blue, approaching a black. Blueing has a tendency to temper hardened steel, which should not be taken below a light blue, which takes a few minutes only; the dark blue takes from 20 to 25 minutes, according to the size of the article.

ENGRAVING.

This artistic process is done by hand, and the execution and detail depends upon the skill and taste of the workman. Sharp triangular-pointed tools are used to cut the designs, which are shaded by finer-pointed gravers.

All the cutting, even the outline, should be cut with gravers. In engraving, steel punches or large gravers are used, and a small hammer; but the lines by these means are apt to be cut too deep, and so make a harbour for the accumulation of dirt and rust.

A gun well engraved should be cut with nice, fine, artistic lines so arranged as to hide all joints round pin-heads, locks, fore-end, lumps, &c.

Any design may be traced upon the metal and cut up. Years ago large scroll, nicely shaded, was the rule; this was followed by game and figures. For some years very fine scroll-work designs have been universally in favour.

A little fine engraving serves well to relieve the plainness of the large surfaces of iron on lock-plates and breech-actions, but very few consider it any advantage to have all the iron-work smothered with scrolls, and any design hidden by the multitude of lines.

BROWNING.

The best method of staining barrels is by the following recipe: but one material fact must not be overlooked. A considerable difficulty exists in staining barrels of laminated steel; in such a case, therefore, the acid should not be so much diluted. 1 oz. muriate tincture of steel; 1 oz. spirits of wine; ¼ oz. muriate of mercury; ¼ oz. strong nitric acid; ⅛ oz. blue stone; 1 quart of water. These are to be well mixed, and allowed to stand a month, to amalgamate. After the oil or grease has been removed from the barrels by lime, the mixture is laid on lightly with a sponge every two hours. It should be scratched off with a steel-wire brush night and morning until the barrels are dark enough; and then the acid is destroyed by pouring on the barrels boiling water, and continuing to rub them till nearly cool.

To stain twist barrels black and white, it is usual, after rubbing and coating with the browning mixture as above, to put them into an iron or block-tin trough, with a small quantity of logwood and sulphate of copper and sufficient water to cover the barrels. The barrels are then boiled in the water for 20 minutes or half an hour. The barrels are then taken out and allowed to cool. When cold, they are scratched off with a steel scratch-brush, and scalded by pouring a kettleful of hot water over them. They must then be rubbed down until nearly cool. The same method of troughing is required to brown them a dark brown; but when they are taken from the trough they are coated with the browning mixture as at first, and scratched off, and re-coated three or four times. They are then finished off by pouring boiling water upon them, and rubbing with soft cloth until nearly cool.

The process of browning takes from four to eight days, according to the temperature of the browning-room. If the barrels are wanted quickly, they may be scratched off as often as three times in twelve hours.

MISCELLANEOUS MOUNTINGS.

The manufacture of gun-mountings comprises many branches. The mountings consist of sights, fore-end fasteners, safety-bolts, nipples and strikers, thumb-pieces, horn tips and heel-plates, and the screw-pins.

The manufacture of rifle sights is in itself a business. A great variety have been introduced either for match rifles, military rifles, long-range rifles, or Express rifles. We describe and illustrate some of these sights when treating of rifles. They are manufactured from forgings, filed and fitted by first-class filers, and hardened, tempered, and coloured. When required, long-range sights are all marked, either with the Vernier scale machine, or by hand, with a graver. Rifle sights are either dovetailed into the rib, or soldered on the barrel. Muzzle sights, for shot guns, are made from iron, silver, or brass wire, and are screwed into the rib.

Fore-end Fasteners.

Of the many fore-end fasteners introduced, the Deeley and Edge is the most in favour, owing to its handiness and neat appearance (see Fig. 201). The Anson patent bolt consists of an iron rod in a tube, kept in position

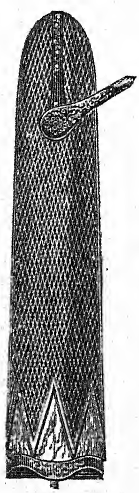


Fig. 199.
Grip Fore-end.

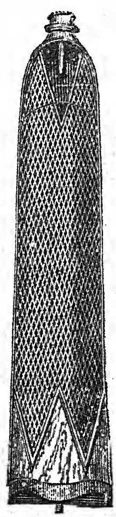


Fig. 200.
Anson Fore-end.

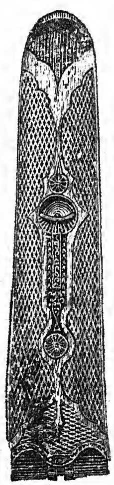


Fig. 201.
"Patent" Fore-end.

Fig. 202.
The "Key" Fore-end

by a spiral spring. The grip fore-end fastener is of a similar construction to the original Lefaucheux lever used in breech-loading guns to secure the barrels. The old bolt, although the most secure, is fast falling into disuse, owing to its requiring a turnscrew to remove the fore-end.

Another modification of the grip-fastener is the key-fastener, much used on the Continent. It is very neat in appearance, and easily disengaged. We give here a few illustrations of fore-end fasteners.

With breech-loaders a secure fore-end fastener is not of so much importance as with the muzzle-loaders; there being no strain upon the bolt, the breech-action itself keeps the barrels firm to the stock : all that is required being a sufficient grip to keep the fore-end to the barrels. The automatic fastener is therefore, although not very secure, a more handy

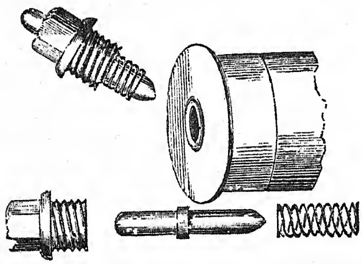


Fig. 203a.

Fig. 203b.

Fig. 203.—Spring Strikers and Nipple.

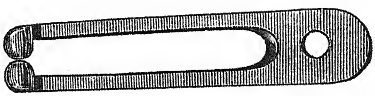


Fig. 204.—Spring Fore-end Fastener.

arrangement than any of the foregoing. There are several varieties, the most common being a sugar-tongs spring clipping in notches either side of the loop. We show the spring in Fig. 204. The fore-end is pushed into its place, and is held there by the spring. It may be removed by simply pulling the fore-end, as near the top as possible, where a notch is left for the finger. The manufacture of the above fasteners is a business in itself. They are usually made in numbers by the patentees, and sold to the trade. They are mostly filed from forgings and castings by action or lock filers. (When fitting up the breech-action in cases similar to ours, where a safety-bolt is used separate from the action, they are filed from forgings by the furniture filer, and fitted to the gun by the finisher.)

Nipples and strikers are turned and screwed in a lathe from forgings by the nipple makers, who supply them in quantities to the trade. The old spring striker, or exploding-pin, is shown in Fig. 203. It is now

superseded by a loose striker, worked by the extractor when opening the gun, see Fig. 203a. This striker is kept in position by a nipple.

Fig. 203b is another pattern striker; this is a solid striker, worked without a spring, and kept in position by a set pin.

Thumb pieces are cast by metal casters and dealers in precious metals, and may be obtained from them either of German silver, silver, or gold, and of any desired shape or size. The silver or gold thumb pieces are usually cut from sheet metal, and soldered on to copper tacks. Silver skeleton heel-plates are sometimes cast for fancy or exhibition guns.

Horn tips and Heel-plates.

The heel-plates are either of buffalo horn or ebonite, and are glued, as well as screwed, to the stocks. The tips and caps, for pistol-hand guns, are of buffalo horn, and glued to the wood.

The anti-recoil heel-plate consists of a layer of pliable vulcanised india-rubber affixed to an ebonite heel-plate. The ebonite is pierced with holes to admit screws for fastening to the stock.

Escutcheons are stamped from sheet iron, in the same manner as washers. They are now but seldom used, having been superseded by patent fore-end fasteners.

Tumbler pins are made by the lock filers, and are tapped, turned, and cut off in the lathe.

The wood screws and iron pins for gun-work are made from the best iron. The wood screws are taper and smoothly finished off, and are always soaped before turned in, to prevent their binding in the wood. The screws are manufactured in the neighbourhood of Birmingham. The same people also make the rifle eyes for slings, &c.

The iron pins are made from rolled bar-iron. They are stamped upon olivers, in much the same manner as described for stamping with dies. Common iron pins are made by screw-cutting machinery from iron wire.

FORGING AND STAMPING.

All the iron for gun-work is specially prepared, it is of a superior quality to that to be generally obtained, and is known as gun-iron. It has to be tolerably soft, and very tough, or it would not stand the

bending and knocking about it receives during the various stages of manufacture.

The forging is performed in much the same manner as may be seen in any blacksmith's shop. The gun-work forger, however, is surrounded with, and has constantly to use, the many tools necessary to the shaping of various articles. Some of their tools fit into the anvil, others are held in the hand and struck with a hammer. By means of these tools, and working upon hollowed and grooved anvils, the forger is able, if he chooses a piece of metal near the size of the article to be forged, to form the required article without any waste, and that will not require much filing to bring it to the necessary shape and size.

The desideratum of good forging is to get the grain of the iron to run in the best direction, to resist the strain given to the article when finished; for instance, in a gun hammer the strain is along the nose, across the finger, and down the body of the cock; to meet this strain the iron is bent with the grain running up the body of the cock, and split at the top, one half being bent at an acute angle to form the finger.

To forge breech-action bodies and other large pieces, heavy hammering is required, and the forging is executed by two men—one using a heavy striking hammer; but the action-bodies, fore-ends, &c., are now usually stamped, which answers admirably where large quantities of articles of same shape and size are required.

Stamped work is especially advantageous where the articles have to be machined afterwards, as all being the same size they fit evenly into the holders.

Stamping is accomplished in the following manner: A model of the article to be stamped is first made, and one half let into a steel block called a die, the other half into another steel block or die, one die forming the bottom, the other the top. Die-sinking, as it is called, is a business of itself, and is applicable to many trades besides that of gun-making.

The dies when finished are hardened, and fixed in a stamp worked by hand and foot for small work, and by steam for bodies, fore-ends, and other heavy forgings. The top die is worked by fastening it into a hammer of wrought or cast iron; this hammer is carried up between two perpendicular rods to the height of 6 or 7 feet, by the aid of a belt or rope over a pulley. The top die is raised, and let fall on the bottom

die, just at the moment that the forger places the iron to form the article, at a welding heat, over the bottom die, and the great weight forces the iron into the top and bottom die, forming the articles to the shape made in the dies. The man working the stamp hammer has it perfectly under his control, and can give a light blow or a heavy one as required.

REBOUNDING LOCKS.

This is a very simple and ingenious contrivance, invented to obviate the necessity of half-cocking. It is accomplished by lengthening the top part of the mainspring, and extending it towards the tumbler; the crank of the tumbler is lengthened beyond the swivel, and projects over the top part of the mainspring. At half-cock the crank of the tumbler rests upon the top part of the mainspring, and keeps the hammers from coming in contact with the exploding-pin or striker. This arrangement makes the lock partly self-acting; the hammers only require to be raised from half to full cock, instead of by the usual mode, which is from the nipple to half-cock, then to full cock. When in the latter position there is the same amount of force exerted by the mainspring upon the tumbler as in the ordinary locks. When the lock is released, by pulling the trigger, the hammer falls with enough force to drive the top part of the mainspring down sufficiently far to admit of the hammers striking the needles with power enough to explode the cartridge, when the hammers immediately rebound to half-cock. There is a half-bent in the tumbler that prevents the hammer being accidentally pushed down on to the exploding-pins; it is much safer to lower the hammer from full to half-cock with the rebounding lock than it is with the old-fashioned one. This system was improved and patented by Mr. Stanton, of Wolverhampton, in 1869, and has since been universally adopted by English and foreign gunmakers for guns.

The first rebounding lock was invented by Bardell and Powell, of Birmingham, and patented by them on Sept. 6th, 1866. This is made with a scear spring, larger and stronger than the ordinary spring. The lower end of the spring bears upon the scear in the ordinary way; the upper end bears on the long arm of a lever whose short arm engages in a notch in the tumbler in such a way as to act against the mainspring, and keep it in

equilibrium at half-cock. When the hammer is let fall from full-cock, the momentum acquired causes it to strike the nipple, or percussion cap, and the action of the scear spring causes it to come back to half-cock, in which position the hammer is then held. There are two other principles of the rebounding lock used in America; one we consider to be nearly as good as Stanton's plan, but the other is not so effective.

It is very probable that this lock will shortly be entirely superseded by the hammerless system, which dispenses altogether with the half-cocking arrangement, and is rapidly coming into favour as a safer weapon.

CONVERTING MUZZLE-LOADERS INTO BREECH-LOADERS.

It is often a difficult matter for the gunmaker to answer off-hand the enquiries repeatedly made relative to the conversion of muzzle-loaders into breech-loaders. Some guns will admit of conversion, but others will not, and in the latter case it is only a waste of money to attempt the operation.

To save time, and the vexation arising from having a good old muzzle-loader spoiled by being converted, we will point out what kinds of barrels are best adapted for converting. In the first place, they should be very strong at the breech, to allow for boring the chambers, so as to admit the cartridge-case, and yet be strong enough to resist the large proof charge that they are subjected to. There are but few muzzle-loaders strong enough for converting. If the guns are wanted to retain their good shooting qualities, they must be fitted with cartridges one size larger than the bore or gauge at the muzzle, if the bore is over 13; but not for a 16-bore, as they take a 15 wad. It should be a No. 14 cartridge for a 15-bore gun, and a No. 12 for a 13-bore.

There being no 11-bore cartridge-cases made, 12-bore guns cannot be converted, unless for the metal case. An 11-bore gun can be made to take a 10-bore cartridge-case. All converted guns have to undergo the process of double proving, and require to be fine-bored, which increases the size.

If the above conditions are complied with, the guns, if properly converted, will shoot as well, and we have known them shoot better, than before alteration.

Now that choke-boring is so well understood, the barrels may be bored advantageously with the muzzle a shade smaller in the bore than the other part of the barrel. This will enable a pattern of 160 to be obtained without in any way affecting the strength of the gun. We recommend, however, a new breech-loader of even fourth quality in preference to converting a muzzle-loader, as the stock may be easily imitated in mount by any practical gunmaker.

Very few muzzle-loading rifles will convert, owing to the difficulty in obtaining cartridge-cases of a suitable size to match the bore of the barrel.

CONVERTING PIN TO CENTRAL-FIRE.

When sportsmen require this alteration they will find it necessary to employ a thoroughly practical gunmaker, as we have known several guns burst through the alteration being badly performed. The two holes to receive the extractor legs must be very carefully drilled, so as not in any way to weaken the gun; if through carelessness the holes are drilled out of proper position, the breech-ends of the barrels are materially weakened and become exceedingly dangerous.

We have also been asked repeatedly to convert ordinary breech-loading hammer guns to the hammerless system. This is totally impracticable, owing to the steel lump on barrels being differently placed, and the lock-work constructed upon a new principle.

CLEANING GUNS.

After a day's shooting, unless the gun can be thoroughly cleaned, it is better to leave it just as it is until the proper time can be given to it. To half wipe out the barrels is more injurious than to leave in the whole of the dirt. The best plan on which to clean out the barrels is to first wipe out with petroleum or turpentine, then wipe dry; this removes all "leading" and deposit. The barrels must then be oiled.

After the season's shooting, or after shooting near salt water, the barrels should be well cleaned inside and out with boiling water, wiped dry, and oiled. This kills all the acid left by the powder, and removes red rust upon the outside of the barrels.

When laying a gun on one side for the summer, both barrels should be

stopped at each end by greased wads, muzzle-stoppers, or the baize-covered sticks sold for the purpose; if the latter, make sure they are perfectly dry before placing them in the barrels.

For oil, any animal oil, if pure, is good; refined neatsfoot oil, or good Russian tallow, or half and half of each, are not to be excelled, provided they contain neither acid or salt; Rangoon oil has also been recommended. The breech-ends of the barrels should never be touched with emery, or other cutting or brightening composition. The lugs of the barrels and the working parts of the breech-action should be oiled occasionally; a mixture of half Russian tallow and half petroleum we find the best, as it will not clog.

For wiping out the barrels, a cleaning-rod, plenty of rag or tow, and a bristle brush are all that is necessary. If rust appears, a wire brush may be used; it will not scratch or injure the barrel if care is taken.

STRIPPING AND REPAIRING GUNS.

To take to pieces a breech-loader for cleaning or repairs, first remove the fore-end and barrels; then with a strong hand turnscrew turn out the side-pins, and remove the locks and hammers together; next turn out the guard-pins, and remove the bow or guard; another pin will then be seen in the rear end of the trigger-plate, remove this pin (occasionally this "hand-pin" is placed in the reverse way, the head of this pin will then be found on the top of the grip in the tang of a long break-off). The "furniture-pin" should next be partly turned out, this pin fastens the fore part of the trigger-plate to the body of the breech-action, and is easily distinguished; next remove the "breech-pin" upon the top of the tang of the break-off; in top lever-action guns the breech-pin is covered by the lever, which must be held on one side whilst the pin is being turned out,—rarely a false pin is screwed into the lever, which, when removed, will leave an aperture through which the breech-pin must be extracted,—after having removed the furniture-pins, the trigger-plate and triggers may be taken from the stock, after which the breech-action may be removed entire.

To strip breech-actions, if the action is a treble-wedge-fast or ordinary top-lever double-bolt action, the first thing will be to remove the spring; to do this first partly turn out the lever spring pin (under tang of break-

off), and with a pair of pliers or pincers, take hold of the spring and slightly grip it, and lift the spring towards the head of the pin. It will then be free from its bearing, and may be removed by completely turning out the spring pin. (This does not apply to spiral springs.) Next proceed to turn out the pin or pins connecting the tumbler with the bottom bolt, and remove the bolt by drawing straight out backwards. Next turn out the lever pin on top of lever, and by means of a small wire punch inserted in the lever pin-hole, knock out the tumbler. The lever may then be removed, and the top bolt, if any, will fall out. In side-lever guns, first knock out the pivot on which the lever works, then remove spring and bolt. Snap guns with lever under-guard may be stripped in much the same manner, but the spring and lever are fixed to the trigger-plate, and the spring must be removed before knocking out the pivot-pin. Owing to the numerous complicated breech-actions that are made, we are unable to say that the above directions will be sufficient to enable an amateur to strip his gun ; but we trust they will be explicit enough as regarding guns of our own make. There are many breech-actions made that puzzle expert gunsmiths to take apart and repair, and it would be foolish for an amateur to attempt to take them apart if a gunmaker is within reasonable distance.

To strip a muzzle-loader, first remove the lock, then the barrels, then proceed to remove the furniture and break-off, as already described for breech-loaders. In military rifles, the bands fastening the barrel to the stock must be loosened by a screw underneath, and then removed by slipping over muzzle of barrel. (Note.—Horn heel-plates are usually glued to the stock, as well as being fastened by the screws.)

To strip a gun-lock, first remove the mainspring,—this may be accomplished with a pair of lock vices, or a cramp may be made by filing a notch or slot in a narrow strip of $\frac{3}{16}$ iron or steel, the size of the breadth of mainspring when at full cock. Having cocked the lock, slip the cramp up the mainspring until it catches, then release the scear and push down the tumbler. The spring being firmly held in the cramp it may be unhooked from the swivel and removed from the lock-plate, then unscrew the bridle-pins and remove the bridle.

The scear may then be lifted off, if the tumbler is not in bent. The scear spring will then be at liberty, and may be removed by turning out the pin.

Now the hammer should be removed; the tumbler-pin is first turned out, and by means of a wire punch inserted in the hole, the tumbler is knocked away from both hammers and lock-plate. If a hammer fits well, it will be impossible to remove it in any other way without injury either to the hammer or the lock. The spring must not be taken out of the cramp; it requires no cleaning except at the claw or hook. In putting a lock together, first screw on the scear spring, then the tumbler, then place on the scears and cramp the spring with a pair of pliers or tongs, place the tumbler into half-bent. Then affix the bridle, and screw it to the lock-plate. Take the mainspring, ready cramped, hook on to the swivel in tumbler, place the stud in the hole drilled for it in the lock-plate, raise the tumbler to full bent, squeeze the mainspring down close to the plate, and remove the cramp; the lock will be ready then for affixing the hammer, which should be knocked on after placing the lock firmly on a solid block to prevent the bridle from breaking. The sellers of hammerless guns, be the mechanism ever so simple or complex, generally give full printed instructions as to proper way of stripping and attending to the gun. As no rule will answer for any two systems, the instructions should be preserved.

In putting guns together, proceed in the reverse order to that described for taking apart. We may, perhaps, as well mention here that in most Russian guns the threads upon the screws turn the reverse way to ours.

We will now proceed to describe the best methods for temporarily repairing guns when hunting beyond the limits of civilisation; but in cases where possible, we should advise the sportsman to send his gun to a practical gunsmith for all repairs. A list of foreign and colonial dealers is appended, and the repairs done by them may be relied upon. The following extra parts of a gun should always be taken when out hunting, or exploring in wild countries:—Extra pair of lock mainsprings, extra hammers or tumblers, pair of extra scears, pair of extra nipples and strikers, extra side-pin, extra action or lever-springs. It is possible that the lever-spring may break, but it will not in any way affect the utility or safety of the arm, only the lever will have to be moved home when the gun is closed, instead of it snapping there. The strikers of ordinary guns will become useless after continued wear, owing to the hardened hammer flattening the head of the striker, and so shortening

its travel as to make missfires of frequent occurrence. The nipple must then be turned out with a key or a pair of pliers, and a new spare striker inserted. In hammerless guns the tumbler and striker being in one, and the point itself striking against the soft copper-cap of the cartridge this flattening does not occur, the strikers being of the best mild steel carefully hardened and tempered, and so well made that breakages are of very rare occurrence. We have had one gun fired over 80,000 shots without the tumbler being any the worse for wear or rust. Perhaps the most usual accident to a sportsman will be the denting, or the bulging of the barrels. When a bruise is discovered, do not in any case shoot out of the gun until the barrels have been repaired, if the bruise is a bad one; for firing out of a badly-bruised barrel invariably causes the barrel to bulge considerably at the bruised part. To remove a dent, the following is the readiest expedient we are acquainted with:—Having removed the barrel from the action or stock, insert in the barrel at the breech-end a solid leaden plug or bullet, as near the size of the barrel as possible, place the barrels on a solid block with a stout ramrod or stick in the barrel, reaching within a few inches of the chamber, then proceed to flatten out the plug or bullet by striking it with another rod and a hammer; the bullet being prevented from slipping down the barrel by the ramrod underneath, it will expand until it perfectly fits the barrel, then proceed to force the plug—having first lubricated it—towards, and gradually past the bruise, turn the plug half round in the barrel, and repeat the process until the bruise is raised. The barrel should be warmed during the process by applying a hot iron to the outside of the bruised part. Great care will have to be taken not to get the plug jammed in the barrel. If a taper lead plug can be obtained, the process will be greatly simplified, and a slightly taper iron or brass plug is much better than a soft lead one. If the barrel is bulged a similar plug should be made, and great care will have to be taken to hammer the bruise down to the plug with a light hammer. If a hard metal plug can be obtained near the required size, it may be packed with paper until of the required diameter. The plug must be slightly longer than the bruise or dent. Another frequent accident in wild countries is the breaking of the gun-stock; this may be securely spliced in the following manner:—First glue the stock as well as possible, then glue round the fracture a piece of thin

leather or canvas, and whilst warm tightly bind with waxed thread or a fine lace; when the whole is dry it will be almost as sound as before. The wood should be warmed before glueing, to enhance the chances of perfect success.

Repairs to breech-actions require great care and experience in effecting, and always when practicable the gun should be sent to the maker, as he has more interest in properly repairing it than anyone else. Country gunmakers frequently spoil breech-actions when repairing, owing to the want of a properly-skilled workman qualified for the particular job. Gun-manufacturers would not allow a screwer or finisher to interfere with the mechanism of a breech-action on any account. To tighten a breech-action, the usual way is to fit a new hinge-pin slightly larger than the old one, or by filing from the flats beneath the barrels, and hammering up the bites on the lump, which process brings the breech-ends of barrels nearer to the face of the standing-breech. When the cartridge bursts at the rim at the upper edge of the case, it is a sure sign that the gun requires to be tightened up.

When guns are thoroughly well made, and have an efficient top connection, they will not require to be tightened up for a long time. Even though they may rattle they will be quite safe to use, and the cartridges, if of good quality, will not burst at the rim.

The best lubricants for gun-locks and breech-actions we find to be half best neatsfoot oil, and half pure paraffin, well mixed. The oil prevents the paraffin from evaporating, whilst the paraffin keeps the oil in a liquid state, and thus prevents it from clogging or becoming sticky.

REMARKS ON THE COST OF GUNS.

Sportsmen often remark that they are unable to understand why there is so great a difference in the prices of best guns, and also that they cannot distinguish between a gun at 40 guineas and one at 20 guineas. Some makers advertise their best guns at 25 guineas, others at 50 guineas, or even 70 guineas. In describing the manufacture of guns, we have not alluded to this matter, except when pointing out the difference between a best Damascus and a plain twist-barrel. We will now proceed

to point out a few of the most striking differences in the cost of producing best, medium, and common breech-loaders.

The barrels of best guns are made from the best iron and steel, and welded into barrels by superior welders; the cheaper grades are made from inferior metal, and either welded under the tilt hammer as already described, or made into barrels by inferior workmen, who from receiving a lower price for their work have to weld a larger number of barrels per week. In the boring and grinding, the common barrels are done at half the cost of the best; this is managed by grinding them without turning and trueing them in the lathe, and by being not so particular about the setting, and if a few rings are left inside from the rough-boring it is counted of no consequence.

In the filing of the barrels the difference is more marked; the common barrels are soldered together with sal-ammoniac and soft solder instead of with rosin, which is far superior, as it prevents the barrels from rusting underneath the ribs. The lumps also are plainly let in, not dovetailed, and the barrels are not struck up or planed round to remove the hills and hollows. Commoner ribs also are used, that is, either scelp twist, or plain iron, and there is not so much care taken to insure the rib being tapered, levelled, straightened, and equally placed on both barrels.

The locks also greatly vary; they may be purchased from two shillings to three guineas the pair. In common locks the tumblers, scears and swivels are of iron, and only the springs of steel. In medium grades the tumblers and scears are of steel, but the bridles are not so well shaped, or the bents so well cut and squared.

We believe there are quite ten classes of workmen in the gun-lock trade who file the locks at various prices, according to their abilities. The furniture is also different in common guns, the triggers and bows are frequently filed from malleable iron castings, instead of from best forged gun-iron. The stocks also vary greatly in quality. In best guns great care is taken in choosing a handsome, sound piece of wood, but in the cheaper grades a few small shakes, galls, and want of figure are not accounted faults.

Breech-actions also vary greatly in quality. Common actions may be fitted complete at nine or ten shillings each, whereas some of the best quality hammerless actions cost as much as £12 or £15 to get up. In breech-

action fitting, as in lock filing, various classes of men are employed, each working at his own quality of work, and having to get through a proportionately larger amount of work the farther it is removed from the best quality: thus, whilst it takes a good workman three days to joint a treble wedge-fast hammerless breech-action, a common action-filer will joint, file, and fit up complete a cheap action in less than half the time.

In the stocking the prices also vary, being chiefly governed by the shape of the lock, bridles, and the breech-action, and the size of the gun. The screwing and finishing vary in price from 3s. 6d. to £5.

The polishing, the browning, &c., all vary considerably in the same manner. The engraving is a branch of the trade which is supposed by many sportsmen to add greatly to the cost of the gun, but it is inconsiderable compared with other branches. It is now possible to completely smother a gun with cheap common engraving for a few shillings.

The very best clean-cut fine scroll engraving may cost as much as 4 or 5 guineas, according to the quantity placed upon the work. Gold inlaying, which is often done, also adds considerably to the cost. The chief item in the cost of good guns is the regulation of the shooting, and alterations of the choking and boring. In addition to the expense of fine-boring, occasionally large numbers of cartridges are required, and a deal of time occupied in the shooting and regulating first-class guns. Most of the leading gunmakers try each of them in the rough as well as in the finished state. Next to safety, this is certainly the most important point in a gun, and great care should always be bestowed by the maker in testing his guns, so as to ensure good results when in actual work. This is a point that the makers of cheap guns never trouble about; and ten or twelve years ago very few best guns were tested, but it was left for the country dealers or the sportsmen to find out the faults or merits, as the case might be.

The difference between a best gun and an inferior one by the same maker is that the one has bestowed upon it every care throughout, and is as near perfection as the ability of that particular maker will allow of its being made, whilst his inferior guns are very possibly those which, originally intended for best, have been found to possess some slight fault that has thrown them to a lower grade. When it is remembered that each gun has to pass through some twenty stages, and the hands

of some thirty or more workmen, each one of whom may spoil the work already done, some idea may be formed of the trouble, care, and expense the production of such a weapon necessarily entails.

None but the most skilled, intelligent, careful, and willing of workmen are capable each of working out harmoniously a preconceived design. A staff in which any member by a slight mishap, a too zealous rivalry of others' work, or the least indiscretion, could ruin the work of the whole, must be expensive to maintain, and, having gained a good reputation for honest work, their productions are of the highest value.

By such a corps, and by no other means whatsoever, can fine guns be produced.

A gun all but finished may develop a flaw in material or workmanship that precludes it from all save the waste heap; so it is that no maker of high reputation can sell his best guns at the prices asked by a less noted maker, who sells guns of mediocre quality produced by workmen of inferior talent, and, there being less waste, pockets greater profits.

Gunmakers who can command over £50 for one of their best guns are few, and it is a mistake to suppose they receive such prices because they are fashionable makers. The truth is, they produce an article worth the money.

A maker uses best material, has skilled workmen, and sells his best production, which costs him—say £15, for £20. It is the best his talents and means allow. Another, out of same quality material, by sparing no pains or endeavour, produces his best at a cost of £38, which he sells for £50. Both are best guns, yet one is infinitely better than the other; and, in all probability, a third or fourth grade gun of the latter would surpass in quality the best of the former, and sell for about the same price.

If a gun is ordered from a country maker, the maker has to come to Birmingham for his barrels and action, locks, &c., and simply stocks and finishes the same, and sends the gun to Birmingham to be polished and engraved; or he buys a gun from Birmingham, and having put on his profit and name, sells it as a weapon of his own manufacture. A few country makers keep three or four men constantly at work, and these usually do three or four branches each; on this account the work can neither be done so cheaply or so well as in Birmingham. We know that there are excellent

makers in Edinburgh and Dublin, and a few other towns, who keep a larger staff of men, but higher wages have to be paid, and the cost of production is considerably increased by having to purchase the raw material and actions from Birmingham gunmakers or factors.

MACHINE-MADE GUNS.

The idea of making guns on the interchangeable system by the aid of machinery appears to have originated with the French during the latter part of the eighteenth century. The process of stamping instead of forging the various parts of the gun was the only successful result, and the honour of working out the system to a successful issue is due to the Americans.

About 1797 Eli Whitney, the owner of cotton mills in some of the Southern States, moved northwards, and was induced to try his fortunes as a gunsmith. A contract for 10,000 arms was secured for him; these he manufactured almost entirely from stamping, and he also applied machinery to the shaping and, as far as possible, to the finishing of the several parts. He also introduced the system of gauges, by which uniformity of construction is insured for parts made after the same model.

John H. Hall, of Harper's Ferry, was the next to improve the system. In 1812 he wrote to the United States Government, laying particular stress upon his plan of making guns. He says:—"Every similar part of my gun is so much alike that it will suit every gun." This system of interchangeability was first applied to Government service by Hall in 1818, and it has since established itself as the rule of the Government workshops. Hall's patent rifle is shown in Fig. 86, page 105.

Blanchard, of Middlebury, Mass., carried the improvements a step beyond either Whitney or Hall, by the application of the lathe to the turning of the barrel and shaping of the gun-stock.

Blanchard required seventeen separate machines for the shaping of his stocks, but by the combination of processes these have since been reduced to thirteen. Some idea of the extent to which the use of machinery in the making of military arms is carried, may be gathered from the fact that at the Providence Tool Company's factory the working plant consists of 1,758 machines, with which it is possible to turn out 800 stand of arms daily.

The various processes through which the several limbs of the gun pass are technically termed "cuts," and in some arms upwards of 1,000 separate cuts have to be made to complete each gun, to say nothing of drilling the various holes, &c.

In England the interchangeable system was introduced about 1856, or at the close of the Crimean War. Colonel Colt, the American inventor, was examined before the House of Commons in 1852, and upon the strength of his evidence a commission visited the armouries of the United States, which resulted in the purchase of machines and the founding of the Government factory at Enfield.

The strikes of the gunmen in Birmingham during the Crimean War undoubtedly greatly influenced our Government to take this step to ensure a sufficient supply of arms in case of emergency; for, during the war, the supply of Enfield rifles was so small that they had to be dispatched after the troops, and some regiments were even armed, *pro. tem.*, with the old Brown Bess. Had the workmen of Birmingham worked during the rush, instead of immediately and continuously striking, in all probability the Government factory would never have been founded; and the two large factories built in Birmingham for the manufacture of military arms by improved machinery would have been fully employed, instead of, as is now the case, remaining idle the greater part of each year.

The making of military arms by machinery, however, has its drawbacks. It impairs the value of skilled labour, for by the division of labour and the subdivision of the various branches, the workman becomes a mere machine, going through the monotonous routine without interest, or endeavour to render more perfect the article he assists in shapening, although, doubtless, the work itself is better done by such subdivisions.

That improvements and changes are not desired in a large machine factory can easily be imagined, as the expense of altering the machines, gauges, and tools is so great, therefore the tardiness in adopting a new model; and whatever may be said in favour of machine-made arms, unless skilled labour is at hand to fall back upon, nations may sometimes be at a loss. For instance, during the American War the machine factories at Harper's Ferry were captured by the South, and the Confederates had to depend for their supply upon *hand-made* guns manufactured by the English and Belgians, and the war had drawn to a close before they could

again set up their machinery to turn out arms in sufficient quantities. In military arms the advantage of the interchangeable system is apparent, but for sporting arms, where in every case individual taste has to be considered, their production must ever be fraught with formidable obstacles, and perfect as works of art they never can be.

Endeavours to produce double shot guns by machinery have not been so successful. The United States for years has been the best market for shot guns, and with the Americans originated the idea of supplying the demand by cheaper production. Several firms embarked in the venture, glutting the market for the time. An enterprising Liège maker followed with similarly made weapons, then a firm in Suhl, with a finely finished machine-made gun; and lastly, an English gunmaker, a practical man and large capitalist, has undertaken to produce similar arms. In all some eight firms will shortly be in work, with an aggregate output of about 1,400 double shot guns per week.

These productions are of various qualities, and each successive model is an improvement on preceding ones, nevertheless—without contending that the production of a perfect machine-made double shot gun is an impossibility—all models yet produced have defects not found in fine or medium quality hand-made guns.

Amongst the faults of the machine-made gun, are : want of proportion in the various parts, ill-shaped ribs, stocks, and hammers, bad fitting of wood against iron, indifferent fitting in breech action and locks ; and in no machine-made gun that we have seen, of American or Continental make, have the barrels been straight either inside or out.

The *differentia* of existing machine-made machine finished guns are: rounded and countersunk screw and pin-heads, "gummy" stocks, weight of the gun not well between the hands, and a general uncouth, military musket appearance.

A machine-made shot gun is but a degenerate specimen of a sporting arm, that all be alike is a *sine quâ non*, and no scope is given for the fancy of workman or artist, no incentive to producing a better arm than all before turned out ; and instead of being a perfectly balanced, proportionate, tastily ornamented and well-built gun, it is but the assemblage of various synoforms, neither artistic nor symmetrical, in many instances a poor, and at best, only a mediocre production.

The machine-made gun has one good point; it permits of no botching of work by jealous or careless workmen, all must be up to a certain standard of excellence—not necessarily a high one—but any faulty limb that might by some mishap be wrongly formed cannot be botched and made to serve; and thus the better models of machine-made guns are likely to be of better quality throughout than the numerous hand-made articles shipped as guns, and sent by the hundred from Birmingham and Liège to the United States and Colonial markets. And only to such are they superior.

For the barrels of these machine-made guns the factories have had to depend upon the hand forgers for their supply, or use steel barrels—decarbonised steel is a misnomer; and such are often brittle and of irregular quality. Belgian two stripe Damascus barrels have been more generally employed, these are of soft metal, and but seldom retain their shooting qualities. The "Daly" gun, of Suhl make, is the best finished of machine-made guns yet on the market; much is done by hand, and finishing processes, too, are introduced that add to its appearance, and no effort has been spared to make it the best machine-made production.

The English gun to compete with these arms, and which is in course of preparation, and will doubtless appear in 1884, will have English two iron Damascus barrels, welded by a new process, retaining the qualities of good hand forged twist barrels, whilst produced at half the cost and with less waste. It will be made in a good assortment of weights and sizes, and each piece will correspond in size to others of its own particular grade only. For instance, the heel-plate or fore-end of a 7-lb., 12-bore gun will not interchange with those of one of 8-lbs., neither will the locks or limbs of a heavy ten and twelve interchange; in short, a greater variety is to be made and attention given to proportions, balance, and the *tout ensemble* of the weapon as well as to the perfect shaping of the separate pieces.

Machine-made guns must be considered a production of mechanical engineering, not of gun-making, and from that stand-point may give that satisfaction which from any other point of view would not be forthcoming.

The magazine shot gun, that is shortly to be placed on the market in various calibres, by the "Sharp's Company," will have an action and magazine mechanism somewhat similar to Fig. 152, will be a well finished and perfectly fitted arm, but from the fact that the balance will be altered at every shot is not likely to succeed well for wing shooting.

THE PROOF OF GUN BARRELS.

IN consequence of the prevalence of the bursting of inferior guns, the Company of Gunmakers of the City of London instituted a proof-house, at which the barrels of respectable makers were all sent to be proved. Whereas by Royal Charter, dated the 14th day of March, 1637, the Master Wardens, and Society of the Mystery of Gunmakers of the City of London (in this Act called the "Gunmakers' Company") were incorporated with powers of searching for and proving and marking all manner of hand guns, great and small, daggs and pistols, and every part thereof, whether made in London or the suburbs, or within ten miles thereof, or imported from Foreign parts, or otherwise brought thither for sale; and a scale for proof was thereby established. And in pursuance of their charter the Gunmakers' Company established the proof-house near the City of London.

In Birmingham a company was formed, and an Act of Parliament obtained in the year 1813, with suitable premises for the proof of gun barrels. This Act proved insufficient, as many makers found easy means of evading it. A fresh Act was obtained in 1855, which enacted that any person or persons making and selling any gun the barrel of which had not been proved at either this or the London Proof-House, became liable to a penalty of £20. And it further enacted that any person or persons forging the stamps or marks of either of the two proof-houses should be liable to the same penalties, and in default of payment, to a certain term of imprisonment, &c. It also ordered that the barrels be proved with the quantity of powder in proportion to the various bores enumerated in the following tables, which are precisely the same for both London and Birmingham proof.

THE GUN BARREL PROOF ACT, 1868.—31 & 32 VICTORIÆ, CAP. CXIII.

An Act for repealing the Gun Barrel Proof Act, 1855, *and for making other provisions in lieu thereof, and for altering the constitution of the Guardians of the Birmingham Proof-House, and for better ensuring the due Proof of Gun Barrels, and for other purposes,* 13*th July*, 1868.

SCHEDULE B.—RULES AND REGULATIONS AND SCALES APPLICABLE TO THE PROOF OF SMALL ARMS.

Classification of Small Arms.

FIRST CLASS.—Comprising Single-barrelled Military Arms of Smooth Bore, not being Breech-loaders or Revolvers.

SECOND CLASS.—Comprising Double-barrelled Military Arms of Smooth Bore, and Rifled Arms of every description, whether one or more Barrels, or constructed of plain or twisted Iron, not being Breech-loaders or Revolvers.

THIRD CLASS.—Comprising every description of Single-barrelled Birding and Fowling Pieces for firing small Shot, and also those known by the name of Danish, Dutch, Carolina, and Spanish, not being Breech-loaders or Revolvers.

FOURTH CLASS.—Comprising every description of Double-barrelled Birding and Fowling Pieces for firing small Shot, and Breech-loading Small Arms of every description and system, not being Revolvers.

FIFTH CLASS.—Comprising Revolving Small Arms of every description and system.

Rule of Proof.

The Gunpowder used shall be of equal Quality and Strength with that which is now used or from Time to Time shall hereafter be used by Her Majesty's War Department.

The Bullets used shall be of Lead, and of the Size and Weight prescribed by the respective Scales for Proof; in Shape, except Bullets used for Rifled Arms, they shall be spherical, cylindrical, or conical.

The Wads used, except Wads used for Rifled Arms, shall be of Felt or Cork, or Paper, and shall not exceed in Thickness the Length of One Diameter of the Bore, one Wad to be placed over the Powder and the other over the Bullet.

As to Rifled Arms of every description, the quantity of Powder used for the First Proof shall be Three hundred per Cent. and for the Second Proof Two hundred per Cent. of the Service Charge. The Bullets used

shall be flattened Projectiles of Lead, and cylindrical, calculated on the Specific Gravity of Lead being 11·352, and for the First and Second Proof they shall be One hundred and thirty-five per Cent. of the Service Weight. The Wads used shall be of solid Felt or Cork, and shall be in thickness the Length of One Diameter of the Bore, one Wad to be placed over the Powder and the other over the Bullet.

Barrels for Arms of the Second and Fourth Classes shall be proved provisionally and definitively, or, at the Request in Writing of the Person or Persons sending the Barrels for Proof, shall be proved once only, in which Case, such Barrels shall be sent in the State for definitive Proof, but shall be proved according to the Scale for provisional Proof, and shall be marked with a special Mark denoting that such Barrels have been proved in the definitive State according to the Scale for provisional Proof; and, subject as hereinafter mentioned, Barrels for all other Arms shall be proved once definitively; but nevertheless the Scale used for proving such Barrels for Arms of the Third Class as have the Diameter of the Bore in every Part One Inch and a Quarter or upwards shall be the provisional Scale.

It shall be sufficient from Time to Time to prove all Breech-loading Military Barrels in the same Manner as Breech-loading Military Barrels made for the use of Her Majesty's Forces, and with the same Weight of Gunpowder and the same description of Cartridge as are now used or from Time to Time shall hereafter be used in the Proof of similar Barrels at the Government Factory at Enfield.

As to any Military Barrel made for the use of Her Majesty's Forces, or for the late Honourable East India Company, which has ceased to belong to Her Majesty, but which bears, in addition to a Proof Mark authorised by Her Majesty's War Department, the Letter O struck (prior to such Cesser) over or upon the Broad Arrow or some part thereof by the said War Department, it shall, if it be a Rifled Barrel be proved with definitive Proof, or if it be a Smooth Bore Barrel with Half the Charge of Powder, but with the same Weight of Bullet which would be applicable to the Proof thereof if such Barrel were an unproved Barrel under this Act, and after either such Proof such Barrel shall be marked as proved definitively; and as to any Military Barrel made for the Use of Her Majesty's Forces, or for the late Honourable East India Company, which has ceased to belong to Her Majesty, and which does not bear, in addition to a Proof

Mark authorised by Her Majesty's War Department, the Letter O or the Letter S struck (prior to such Cesser) over or upon the Broad Arrow or some Part thereof by that Department, it shall (whether it shall or shall not bear a Proof Mark authorised by that Department) be liable to Proof as an unproved Barrel according to its Classification under this Act.

Conditions precedent to Proof.

Barrels for Arms of the First Class shall not be qualified for Proof until they shall be in a fit and proper State for setting up, and the Thread of the Screws sound and full.

Barrels for Arms of the Third Class shall not be qualified for Proof until they shall be in a fit and proper State for setting up, with the Squares set off looped, and the proper Breeches in the Thread of the Screws sound and full; and all Barrels lumped for percussioning shall be proved through the Nipple with the proper Pins or Plugs in.

Barrels for Arms of the Second and Fourth Classes:

For provisional Proof:—If of Plain Metal, shall be bored and ground having Plugs attached, with Touch-holes drilled in the Plugs of a Diameter not exceeding One Sixteenth of an Inch. Notches in the Plugs, instead of drilled Touch-holes, shall disqualify for Proof. If of twisted Metal, they shall be fine-bored, and struck up with proving Plugs attached, and Touch-holes drilled, as in the Case of plain Metal Barrels.

For definitive Proof:—The Barrels, whether of plain or twisted Metal, shall be smoothed in the finished State with the Breeches in the percussioned State, Huts filed up, Bars of Barrels intended for Bar Locks properly filed up on the Top and Bottom Sides, the Top and Bottom Ribs of Double Barrels shall be rough struck up, Pipes, Loops, and Stoppers, on the proper Breeches in the Thread of the Screws sound and full, and all Rifle Barrels shall be rifled.

Barrels for Breech-loading Arms, all which are subject to provisional Proof and to definite Proof, shall receive the latter Proof after the Breech-loading Action is attached and complete.

Barrels for Revolving Arms shall have the Cylinders or Chambers with the Revolving Action attached and complete.

Marks of Proof.

The Marks denoting definite Proof shall be the Proof and View Marks now used by the Two Companies respectively ; (that is to say,)

As to the Gunmakers' Company:

The letters G P interlaced in a Cypher surmounted by a Crown, and the View Mark being the letter V surmounted by a Crown ; (videlicit,)

As to the Guardians:

Two Sceptres crossed, a Crown in the top Angle formed by the crossing of the Sceptres, the Letter B in the proper right Angle, the Letter C in the proper left Angle, and the Letter P in the lower Angle ; and the View Mark being Two Sceptres crossed, a crown in the top Angle formed by the crossing of the Sceptres, and the lower Angle the Letter V ; (videlicit,)

The Marks denoting provisional Proof shall be as follows:

As to the Gunmakers' Company:

The Letters G P interlaced in a Cypher surmounted by a Lion rampant; (videlicit,)

As to the Guardians:

The Letters B P interlaced in a Cypher surmounted by a Crown; (videlicit,)

The Marks denoting provisional Proof of Barrels proved in the State for definite Proof shall be as follows:

As to the Gunmakers' Company:

The Letters V G P interlaced in a Cypher surmounted by a Lion rampant; (videlicit,)

As to the Guardians:

The Letters V B P interlaced in a Cypher surmounted by a Crown; (videlicit,)

Mode of affixing Proof Marks.

On Arms of the First, Third, and Fifth Classes the definitive Proof Mark and View Mark shall be impressed at the Breech End of the Barrel, and if the Barrel be constructed with a Patent Breech or with Revolving Cylinders or Chambers the View Mark shall be also impressed upon the Breech, or upon every Cylinder or Chamber, if more than One, with which the Barrel is connected.

On Arms of the Second and Fourth Classes proved provisionally and definitively the provisional Proof Mark shall be impressed at the Breech

End of the Barrel, and the definitive Proof Mark and View Mark shall be impressed upon the Barrel above the provisional Proof Mark; and if the Barrel be constructed with a Patent Breech, or with a Breech-loading Action, or with Breech Blocks or Chambers, the View Mark shall be also impressed upon the Breech or Breech-loading Action, or upon each of the Breech Blocks or Chambers, if more than One, with which the Barrel is connected.

On Arms of the Second and Fourth Classes proved provisionally in the State for definitive Proof the Proof Mark shall be impressed at the Breech End of the Barrel, and if the Barrel be constructed with a Patent Breech, or with a Breech-loading Action, or with Breech Blocks or Chambers, shall be also impressed upon the Breech or Breech-loading Action, or upon each of the Breech Blocks or Chambers, if more than One, with which the Barrel is connected.

On all Barrels the Gauge Size of the Barrel shall be struck at the definitive Proof.

SCALE FOR PROOF OF RIFLED SMALL ARMS OF EVERY DESCRIPTION.

Number of Gauge.	Diameter of Bore.	Bullet for Proof.				Charge of Powder for						Service Charge.			
		Diameter.	Length.	Ratio of Length to Diameter.	Weight.	First Proof.			Second Proof.			Powder.			Ball.
	inches.	inches.	inches		grains.	grains.	oz.	drs.	grains	oz.	drs.	grains.	oz.	drs.	grains.
1	1·669	1·649	2·474	1·500	15186·0	3417	7	13	2278	5	3¼	1139	2	9¾	11390
	1·500	1·480	2·220	1·500	10977·0	2470	5	10¼	1646	3	12¼	823	1	14	8233
2	1·325	1·305	1·958	1·500	7527·1	1694	3	14	1129	2	9¼	565	1	4¾	5645
	1·250	1·230	1·845	1·500	6300·9	1418	3	3¾	945	2	2½	473	1	1¼	4726
3	1·157	1·137	1·706	1·500	4978·5	1120	2	9	747	1	11¼	373	0	13¾	3734
4	1·052	1·032	1·548	1·500	3721·6	837	1	14½	558	1	4½	279	0	10¼	2791
	1·000	·980	1·470	1·509	3186·9	717	1	10¼	478	1	1½	239	0	8¾	2390
5	·976	·956	1·434	1·500	2958 4	666	1	8¼	444	1	0¼	222	0	8	2219
6	·919	·899	1··49	1·500	2461·1	554	1	4¼	369	0	13½	185	0	6¾	1846
	·900	·880	1·320	1·500	2307·5	519	1	3	346	0	12¾	173	0	6¼	1731
7	·873	·853	1·280	1·500	2102·3	473	1	1¼	315	0	11½	158	0	5¾	1577
	·850	·830	1·245	1·500	1936·1	436	1	0	290	0	10½	145	0	5¼	1452
8	·835	·815	1·223	1·500	1833·7	413	0	15	275	0	10	138	0	5	1375
9	·803	·783	1·175	1·500	1626·1	366	0	13½	244	0	9	122	0	4½	1220
	·800	·780	1·170	1·500	1606·8	362	0	13¼	241	0	8¾	121	0	4½	1205
10	·775	·755	1·132	1·500	1456·6	328	0	12	219	0	8	109	0	4	1092
	·770	·750	1·126	1·501	1429·7	322	0	11¾	215	0	7¾	107	0	4	1072
	·760	·740	1·112	1·503	1374·6	310	0	11¼	207	0	7½	103	0	3¾	1031
11	·751	·731	1·100	1·505	1326·9	301	0	11	200	0	7¼	100	0	3¾	995

Number of Gauge.	Diameter of Bore.	Bullet for Proof. Diameter.	Length.	Ratio of Length to Diameter.	Weight.	Charge of Powder for First Proof.			Second Proof.			Service Charge. Powder.			Ball.
	inches.	inches.	inches.		grains.	grains.	oz.	drs.	grains.	oz.	drs.	grains.	oz.	drs.	grains.
	·750	·730	1·099	1·505	1322·0	300	0	11	200	0	7¼	100	0	3¾	992
	·740	·720	1·085	1·507	1269·7	289	0	10½	193	0	7	96	0	3½	952
	·730	·710	1·071	1·509	1218·7	279	0	10¼	186	0	6¾	93	0	3½	914
12	·729	·709	1·070	1·509	1214·2	278	0	10¼	185	0	6¾	93	0	3½	911
	·720	·700	1·058	1·511	1170·2	269	0	9¾	180	0	6½	90	0	3¼	878
13	·710	·690	1·045	1·514	1123·1	260	0	9½	173	0	6¼	87	0	3¼	842
	·700	·680	1·032	1·518	1077·2	252	0	9¼	168	0	6¼	84	0	3	808
14	·693	·673	1·024	1·521	1047·0	246	0	9	164	0	6	82	0	3	785
	·690	·670	1·020	1·523	1033·6	244	0	9	162	0	6	81	0	3	775
	·680	·660	1·009	1·529	992·1	236	0	8¾	158	0	5¾	79	0	3	744
15	·677	·657	1·006	1·531	980·2	235	0	8½	156	0	5¾	78	0	2¾	735
	·670	·650	·999	1·537	952·8	230	0	8½	154	0	5½	77	0	2¾	715
16	·662	·642	·992	1·545	923·0	226	0	8¼	151	0	5½	75	0	2¾	692
	·660	·640	·990	1·547	915·4	225	0	8¼	150	0	5½	75	0	2¾	687
	·650	·630	·982	1·559	879·8	220	0	8	147	0	5¼	73	0	2¾	660
17	·649	·629	·981	1·560	876·1	220	0	8	146	0	5¼	73	0	2¾	657
	·640	·620	·977	1·575	847·8	217	0	8	145	0	5¼	72	0	2¾	636
18	·637	·617	·975	1·581	837·9	216	0	8	144	0	5¼	72	0	2¾	628
	·630	·610	·974	1·596	818·1	214	0	7¾	143	0	5¼	71	0	2½	614
19	·626	·606	·973	1·606	806·6	213	0	7¾	142	0	5¼	71	0	2½	605
	·620	·600	·974	1·623	791·5	212	0	7¾	141	0	5¼	71	0	2½	594
20	·615	·595	·975	1·638	779·2	211	0	7¾	141	0	5¼	70	0	2½	584
	·610	·590	·978	1·657	768·5	211	0	7¾	141	0	5¼	70	0	2½	576
21	·605	·585	·980	1·676	757·1	210	0	7¾	140	0	5	70	0	2½	568
	·600	·580	·985	1·698	748·0	209	0	7¾	140	0	5	70	0	2½	561
22	·596	·576	·988	1·715	739·9	209	0	7¾	139	0	5	70	0	2½	555
	·590	·570	·995	1·746	729·7	208	0	7½	139	0	5	69	0	2½	547
23	·587	·567	·999	1·762	725·0	207	0	7½	138	0	5	69	0	2½	544
	·580	·560	1·012	1·808	716·4	205	0	7½	137	0	5	68	0	2½	537
24	·579	·559	1·015	1·816	716·0	205	0	7½	137	0	5	68	0	2½	537
Regulation bore	·577	·557	1·021	1·833	715·0	205	0	7½	137	0	5	68	0	2½	536
25	·571	·551	1·043	1·893	715·0	205	0	7½	137	0	5	68	0	2½	536
	·570	·550	1·047	1·904	715·0	205	0	7½	137	0	5	68	0	2½	536
26	·563	·543	1·074	1·978	715·0	205	0	7½	137	0	5	68	0	2½	536
	·560	·540	1·086	2·012	715·0	205	0	7½	137	0	5	68	0	2½	536
27	·556	·536	1·103	2·057	715·0	205	0	7½	137	0	5	68	0	2½	536
28	·550	·530	1·128	2·128	715·0	205	0	7½	137	0	5	68	0	2½	536
29	·543	·523	1·158	2·214	715·0	205	0	7½	137	0	5	68	0	2½	536
	·540	·520	1·171	2·253	715·0	205	0	7½	137	0	5	68	0	2½	536
30	·537	·527	1·185	2·292	715·0	205	0	7½	137	0	5	68	0	2½	536
31	·531	·511	1·213	2·374	715·0	205	0	7½	137	0	5	68	0	2½	536
	·530	·510	1·218	2·388	715·3	205	0	7½	137	0	5	68	0	2½	536
32	·526	·506	1·237	2·445	715·0	205	0	7½	137	0	5	68	0	2½	536
33	·520	·500	1·267	2·534	715·0	205	0	7½	137	0	5	68	0	2½	536
34	·515	·495	1·293	2·612	715·0	205	0	7½	137	0	5	68	0	2½	536
35	·510	·490	1·319	2·692	715·0	205	0	7½	137	0	5	68	0	2½	536
36	·506	·486	1·341	2·759	715·0	205	0	7½	137	0	5	68	0	2½	536

Number of Gauge.	Diameter of Bore.	Bullet for Proof. Diameter.	Bullet for Proof. Length.	Bullet for Proof. Ratio of Length to Diameter.	Bullet for Proof. Weight.	Charge of Powder for First Proof.			Charge of Powder for Second Proof.			Service Charge. Powder.			Service Charge. Ball.
	inches.	inches.	inches.		grains.	grains.	oz.	drs.	grains.	oz.	drs.	grains.	oz.	drs.	grains.
37	·501	·481	1·369	2·846	715·0	205	0	7½	137	0	5	68	0	2½	536
	·500	·480	1·375	2·864	715·0	205	0	7½	137	0	5	68	0	2½	536
38	·497	·477	1·392	2·918	715·0	205	0	7½	137	0	5	68	0	2½	536
39	·492	·472	1·422	3·012	715·0	205	0	7½	137	0	5	68	0	2½	536
	·490	·470	1·434	3·051	715·0	205	0	7½	137	0	5	68	0	2½	536
40	·488	·468	1·446	3·090	715·0	205	0	7½	137	0	5	68	0	2½	536
41	·484	·464	1·471	3·171	715·0	205	0	7½	137	0	5	68	0	2½	536
42	·480	·460	1·497	3·254	715·0	205	0	7½	137	0	5	68	0	2½	536
43	·476	·456	1·523	3·341	715·0	205	0	7½	137	0	5	68	0	2½	536
44	·473	·453	1·544	3·407	715·0	205	0	7½	137	0	5	68	0	2½	536
	·470	·450	1·564	3·476	715·0	205	0	7½	137	0	5	68	0	2½	536
45	·469	·449	1·571	3·499	715·0	205	0	7½	137	0	5	68	0	2½	536
46	·466	·446	1·592	3·570	715·0	205	0	7½	137	0	5	68	0	2½	536
47	·463	·443	1·614	3·643	715·0	205	0	7½	137	0	5	68	0	2½	536
	·460	·440	1·636	3·718	715·0	205	0	7½	137	0	5	68	0	2½	536
48	·459	·439	1·644	3·744	715·0	205	0	7½	137	0	5	68	0	2½	536
49	·456	·436	1·666	3·822	715·0	205	0	7½	137	0	5	68	0	2½	536
50·	·453	·433	1·689	3·902	715·0	205	0	7½	137	0	5	68	0	2½	536
Small Bore	·451	·431	1·705	3·956	715·0	205	0	7½	137	0	5	68	0	2½	536
51·05	·450	·430	1·711	3·978	714·1	205	0	7½	137	0	5	68	0	2½	536
54·61	·440	·420	1·757	4·183	699·6	203	0	7½	135	0	5	68	0	2½	525
58·50	·430	·410	1·781	4·344	675·8	198	0	7¼	132	0	4¾	66	0	2½	507
62·78	·420	·400	1·786	4·465	645·1	191	0	7	127	0	4¾	64	0	2¼	484
67·49	·410	·390	1·781	4·567	611·5	183	0	6¾	122	0	4½	61	0	2¼	459
72·68	·400	·380	1·769	4·654	576·6	174	0	6¼	116	0	4¼	58	0	2	432
78·41	·390	·370	1·749	4·728	540·5	165	0	6	110	0	4	55	0	2	405
84·77	·380	·360	1·724	4·790	504·4	155	0	5¾	103	0	3¾	52	0	2	378
91·83	·370	·350	1·695	4·843	468·7	145	0	5¼	97	0	3½	48	0	1¾	352
99·70	·360	·340	1·663	4·890	434·0	136	0	5	91	0	3¼	45	0	1¾	325
108·49	·350	·330	1·627	4·930	400·0	126	0	4½	84	0	3	42	0	1½	300
118·35	·340	·320	1·587	4·960	366·8	117	0	4¼	78	0	2¾	39	0	1½	275
129·43	·330	·310	1·543	4·978	334·7	108	0	4	72	0	2½	36	0	1¼	251
141·95	·320	·300	1·497	4·990	304·1	99	0	3½	66	0	2½	33	0	1¼	228
156·14	·310	·290	1·449	4·997	275·1	90	0	3¼	60	0	2¼	30	0	1	206
172·28	·300	·280	1·400	5·000	247·8	82	0	3	55	0	2	27	0	1	186

New Rules and Regulations made in the month of July, 1875, by the Gunmakers' Company and the Guardians of the Birmingham Proof House, as to the proof of choke-bore gun barrels, which means barrels whereof the diameter of the bore at the muzzle is less than the diameter of the bore at some point behind the muzzle, other than the chamber or recess which contains the cartridge. For the definitive proof of choke-bored barrels, shot shall be used instead of bullets: the shot used shall be of lead, and of the size and description known in the gun trade as soft shot, size No. 6. The charge of shot shall be in the aggregate of the weight prescribed as the weight of the bullet for proof, by the scale set forth in the said Schedule B, called Scale for Proof of Small Arms of every description, except rifled small arms, taking the diameter of the bore of the barrel at its widest part, exclusive of the chamber or recess containing the cartridge. The wads used shall be placed one over the powder and the other over the charge of shot.

AS TO MARKS OF PROOF.

14.—The marks denoting definitive proof of choke-bored barrels shall be the proper letter or figure or figures, denoting the gauge size of the barrel at its widest part, exclusive of the chamber or recess containing the cartridge, followed immediately, except in the case hereinafter excepted, by the letter B, and the proper letter or figure or figures denoting the gauge size of the barrel at its muzzle, followed immediately by the letter M, which letters or figures denoting the gauge sizes, respectively, shall be struck at the definitive proof; and the proof and view marks now used by the said two Companies, respectively, as described and delineated in Schedule B aforesaid, with the addition of the words "Not for Ball,' which words shall be struck on the barrel on that side of the letters B and M, respectively, which is nearest to the muzzle (videlicit),

As to the Gunmakers' Company—

12 B
14 M NOT FOR BALL.

SCALE FOR PROOF OF SMALL ARMS OF EVERY DESCRIPTION EXCEPT RIFLED SMALL ARMS.

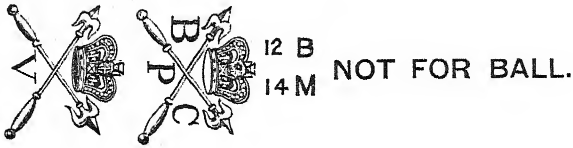
No. of Gauge.	Diameter of Bore by Calculation.	Bullets for Proof.		Charges of Powder for Proof. First Class. Definitive Proof.			Second Class. Provisional Proof.			Second Class. Definitive Proof.			Third Class. Provisional Proof.			Third Class. Definitive Proof.			Fourth Class. Provisional Proof.			Fourth Class. Definitive Proof.		
		Diameter.	Weight.	grains.	ozs.	drs.	grains.	ozs.	drs.	grains.	ozs.	drs.	grains.	ozs.	drs.	grains.	ozs.	drs.	grains.	ozs.	drs.	grains.	ozs.	drs.
	inches.	inches.	grains.																					
A	2·000	1·980	11682	—	—	—	—	—	—	—	—	—	8214	18	12¾	5841	13	5½	8214	18	12¾	5841	13	5½
B	1·938	1·918	10618	—	—	—	—	—	—	—	—	—	7466	17	1	5309	12	2¼	7466	17	1	5309	12	2¼
C	1·875	1·855	9606	—	—	—	—	—	—	—	—	—	6754	15	7	4803	10	15¾	6754	15	7	4803	10	15¾
D	1·813	1·793	8675	—	—	—	—	—	—	—	—	—	6100	13	15	4338	9	14¾	6100	13	15	4338	9	14¾
E	1·750	1·730	7792	—	—	—	—	—	—	—	—	—	5479	12	8½	3896	8	14½	5479	12	8½	3896	8	14½
F	1·688	1·668	6984	—	—	—	—	—	—	—	—	—	4911	11	3½	3492	7	15¾	4911	11	3½	3492	7	15¾
1	1·669	1·649	6752	—	—	—	—	—	—	—	—	—	4748	10	13¾	3376	7	11½	4748	10	13¾	3376	7	11½
H	1·625	1·605	6222	—	—	—	—	—	—	—	—	—	4375	10	0	3111	7	1¾	4375	10	0	3111	7	1¾
J	1·563	1·543	5529	—	—	—	—	—	—	—	—	—	3887	8	14¼	2764	6	5	3887	8	14¼	2764	6	5
K	1·500	1·480	4879	—	—	—	—	—	—	—	—	—	3431	7	13½	2440	5	9¼	3431	7	13½	2440	5	9¼
L	1·438	1·418	4291	—	—	—	—	—	—	—	—	—	3017	6	14¼	2146	4	14½	3017	6	14¼	2146	4	14½
M	1·375	1·355	3744	—	—	—	—	—	—	—	—	—	2633	6	0¼	1872	4	4½	2633	6	0¼	1872	4	4½
2	1·325	1·305	3342	—	—	—	—	—	—	—	—	—	2350	5	6	1671	3	13	2350	5	6	1671	3	13
O	1·313	1·293	3253	—	—	—	—	—	—	—	—	—	2287	5	3¾	1627	3	11½	2287	5	3¾	1627	3	11½
P	1·250	1·230	2800	—	—	—	—	—	—	—	—	—	1969	4	8	1400	3	3¼	1969	4	8	1400	3	3¼
3	1·157	1·137	2211	1555	3	8¾	1555	3	8¾	778	1	12½	—	—	—	1244	2	13½	1244	2	13½	778	1	12½
4	1·052	1·032	1649	1159	2	10½	1159	2	10½	580	1	5¼	—	—	—	928	2	2	928	2	2	580	1	5¼
5	·976	·956	1315	925	2	1¾	925	2	1¾	463	1	1	—	—	—	740	1	11	740	1	11	463	1	1
6	·919	·899	1090	766	1	12	766	1	12	383	—	14	—	—	—	612	1	6½	612	1	6½	383	—	14
7	·873	·853	931	656	1	8	656	1	8	328	—	12	—	—	—	525	1	3¼	525	1	3¼	328	—	12
8	·835	·815	812	602	1	6	602	1	6	301	—	11	—	—	—	481	1	1½	481	1	1½	301	—	11
9	·803	·783	720	492	1	2	492	1	2	246	—	9	—	—	—	394	—	14½	394	—	14½	246	—	9
10	·775	·755	646	465	1	1	465	1	1	232	—	8½	—	—	—	372	—	13½	372	—	13½	232	—	8½
11	·751	·731	586	437	—	16	437	—	16	219	—	8	—	—	—	350	—	12¾	350	—	12¾	219	—	8
12	·729	·709	535	437	—	16	437	—	16	219	—	8	—	—	—	350	—	12¾	350	—	12¾	219	—	8
13	·710	·690	493	410	—	15	410	—	15	205	—	7½	—	—	—	328	—	12	328	—	12	205	—	7½
14	·693	·673	457	383	—	14	383	—	14	191	—	7	—	—	—	306	—	11¼	306	—	11¼	191	—	7
15	·677	·657	425	383	—	14	383	—	14	191	—	7	—	—	—	305	—	11¼	306	—	11¼	191	—	7
16	·662	·642	399	369	—	13½	369	—	13½	185	—	6¾	—	—	—	295	—	10¾	295	—	10¾	185	—	6¾

17	·649	·629	374	369	—	13½	369	—	13½	185	—	6¾	—	—	—	295	—	10¾	295	—	10¾	185	—	6¾
18	·637	·617	352	342	—	12½	342	—	12½	171	—	6¼	—	—	—	273	—	10	273	—	10	171	—	6¼
19	·626	·606	334	301	—	11	301	—	11	150	—	5½	—	—	—	241	—	8¾	241	—	8¾	150	—	5½
20	·615	·595	316	273	—	10	273	—	10	137	—	5	—	—	—	219	—	8	219	—	8	137	—	5
21	·605	·585	300	273	—	10	273	—	10	137	—	5	—	—	—	219	—	8	219	—	8	137	—	5
22	·596	·576	287	246	—	9	246	—	9	123	—	4½	—	—	—	197	—	7¼	197	—	7¼	123	—	4½
23	·587	·567	274	246	—	9	246	—	9	123	—	4½	—	—	—	197	—	7¼	197	—	7¼	123	—	4½
24	·579	·559	262	232	—	8½	232	—	8½	116	—	4¼	—	—	—	186	—	6¾	186	—	6¾	116	—	4¼
25	·571	·551	251	232	—	8½	232	—	8½	116	—	4¼	—	—	—	186	—	6¾	186	—	6¾	116	—	4¼
26	·563	·543	242	232	—	8½	232	—	8½	116	—	4¼	—	—	—	186	—	6¾	186	—	6¾	116	—	4¼
27	·556	·536	231	232	—	8½	232	—	8½	116	—	4¼	—	—	—	186	—	6¾	186	—	6¾	116	—	4¼
28	·550	·530	223	232	—	8½	232	—	8½	116	—	4¼	—	—	—	186	—	6¾	186	—	6¾	116	—	4¼
29	·543	·523	214	205	—	7½	205	—	7½	102	—	3¾	—	—	—	164	—	6	164	—	6	102	—	3¾
30	·537	·517	207	205	—	7½	205	—	7½	102	—	3¾	—	—	—	164	—	6	164	—	6	102	—	3¾
31	·531	·511	—	205	—	7½	205	—	7½	102	—	3¾	—	—	—	164	—	6	164	—	6	102	—	3¾
32	·526	·506	194	205	—	7½	205	—	7½	102	—	3¾	—	—	—	164	—	6	164	—	6	102	—	3¾
33	·520	·500	—	191	—	7	191	—	7	96	—	3½	—	—	—	153	—	5½	153	—	5½	96	—	3½
34	·515	·495	182	191	—	7	191	—	7	96	—	3½	—	—	—	153	—	5½	153	—	5½	96	—	3½
35	·510	·490	—	191	—	7	191	—	7	96	—	3½	—	—	—	153	—	5½	153	—	5½	96	—	3½
36	·506	·486	172	191	—	7	191	—	7	96	—	3½	—	—	—	153	—	5½	153	—	5½	96	—	3½
37	·501	·481	—	191	—	7	191	—	7	96	—	3½	—	—	—	153	—	5½	153	—	5½	96	—	3½
38	·497	·477	162	178	—	6½	178	—	6½	89	—	3¼	—	—	—	142	—	5¼	142	—	5¼	89	—	3¼
39	·492	·472	—	178	—	6½	178	—	6½	89	—	3¼	—	—	—	142	—	5¼	142	—	5¼	89	—	3¼
40	·488	468	154	178	—	6½	178	—	6½	89	—	3¼	—	—	—	142	—	5¼	142	—	5¼	89	—	3¼
41	·484	·464	—	164	—	6	164	—	6	82	—	3	—	—	—	131	—	4¾	131	—	4¾	82	—	3
42	·480	·460	146	164	—	6	164	—	6	82	—	3	—	—	—	131	—	4¾	131	—	4¾	82	—	3
43	·476	·456	—	164	—	6	164	—	6	82	—	3	—	—	—	131	—	4¾	131	—	4¾	82	—	3
44	·473	·453	139	164	—	6	164	—	6	82	—	3	—	—	—	131	—	4¾	131	—	4¾	82	—	3
45	·469	·449	—	150	—	5½	150	—	5½	75	—	2¾	—	—	—	120	—	4½	120	—	4½	75	—	2¾
46	·466	·446	133	150	—	5½	150	—	5½	75	—	2¾	—	—	—	120	—	4½	120	—	4½	75	—	2¾
47	·463	·443	—	150	—	5½	150	—	5½	75	—	2¾	—	—	—	120	—	4½	120	—	4½	75	—	2¾
48	·459	·439	127	150	—	5½	150	—	5½	75	—	2¾	—	—	—	120	—	4½	120	—	4½	75	—	2¾
49	·556	·436	—	150	—	5½	150	—	5½	75	—	2¾	—	—	—	120	—	4½	120	—	4½	75	—	2¾
50	·453	·433	122	150	—	5½	150	—	5½	75	—	2¾	—	—	—	120	—	4½	120	—	4½	75	—	2¾

N.B.—Revolving Arms shall be proved according to the Scale laid down for Definitive Proof of the Fourth Class. A Barrel of any description to which the foregoing Scales of Proof are inapplicable or unsuitable shall be proved with such a Bullet as shall be applicable to the Dimensions of the Bore of such Barrel, and with such a Charge of Gunpowder as shall not be less than twice the Service Charge, or in case the Barrel shall not be capable of holding twice the Service Charge, with as much Powder as the Barrel shall be capable of holding.

L

As to the Guardians of the Birmingham Proof-House—



The excepted case hereinbefore referred to is that of barrels the bore of which is enlarged immediately behind the muzzle, but of which, except such enlargement, and also except the chamber or recess containing the cartridge, the bore is not in any part of it larger than at the muzzle.

As to every such barrel, the word "Choke" shall be substituted for the words "Not for Ball" in the proof mark aforesaid, but in all other respects the marks denoting definitive proof of choke-bored barrels of every description shall be identical.

15.—The marks denoting definitive proof of barrels not being choke-bored barrels, shall be the proper letter or figure or figures denoting the gauge size of the barrel, which letter or figure or figures shall be struck at the definitive proof; and the proof and view marks, now used by the said two Companies respectively as described and delineated in Schedule B to the said Act.

16.—When any barrel of any small-arm, which barrel has been proved definitively, or which has been proved in the state for definitive proof, but according to the scale for provisional proof, is brought to the Proof House, or any branch Proof House of either of the said two Companies, to be proved again, definitively, or according to the scale for provisional proof, if such barrel upon being so proved again, does not stand proof, the person or persons respectively, who, under the said Act, is or are entitled to impress marks of proof on such barrel, shall efface all the existing marks of definitive proof therefrom.

Gun barrels which are bored the recess pattern, see Figs. 271—4, are marked "Choke;" the true choke-bore barrels, see Figs. 271—6, are marked "Not for Ball." We are continually asked by sportsmen why these choke-bored barrels are marked "Not for Ball." The Proof authorities consider that it is not safe to use ball in such bored barrels.

When the size of the ball is equal to the bore of the barrels at the breech, the result would be that the barrels would burst or bulge at the choke which is near the muzzle. We know of an instance in which one of our best choke-bore guns got made into a cylinder through the use of a bullet as above described. If the barrels had not been of a superior metal, the consequence would have been a bulge or burst. We may remark that a bullet can be occasionally fired from a choke-bore barrel if the bullet is slightly smaller than the barrels at the muzzle, and a small charge of powder only is used.

MODE OF PROVING.

A description of the *modus operandi* in the proof of gun barrels may be interesting to sportsmen and gunmakers in those countries in which no proof-house exists. The system of proving at both the Birmingham and London proof-houses are identical. Each barrel passes through the proof-house with a number attached to it, so that the name of the owner or maker is not known to the workmen, who therefore have no opportunity, if they were so willed, of spoiling the article from spite or malice against the maker. Before the barrel is sent into the loading-room it is gauged by plugs and stamped with a number. The workman whose duty it is to stamp the barrels stands at a bench upon which fifty or sixty numbered steel punches are arranged in order. Corresponding to these are numbered gauging-plugs, varying in size from that of a pea up to two inches. Having ascertained the exact bore of the barrel by means of one of these plugs, he takes up a punch, bearing a similar number to the plug, and stamps that number upon the barrel—say seventeen. The man whose duty it is to load the barrel, seeing the number, is able to judge of the proper amount of loading to put in it. Leaving this room and following a short tramway, along which the barrels are conveyed, we come to the "Loading-Room." Here everything is done by rule and measure, every precaution taken to ensure safety, and every means used to prevent fraud. The room is divided into three compartments, separated by strong brick walls, so that should an explosion occur in either the injury would be confined to the division in which it took place. The floors of these rooms are always kept damp and well swept. In the first compartment the barrels

are loaded by one man who has the barrels arranged round the room. In front of him is a rack of copper measures numbered successively from one up to about fifty; upon ascertaining the number stamped upon the barrel by the man in the receiving-room, he takes up one of the measures bearing a corresponding number, and having filled it with gunpowder from a bowl by his side, he places the charge in the barrel; he next takes a proper-sized cork wad and a leaden plug from a numbered box corresponding with the bores, and afterwards a second cork wad with which he loads the barrel. Thus loaded the barrels are passed into the next compartment, where the charge is duly rammed home with copper rods prepared for the purpose. The barrel is then passed on to the third compartment, where it is primed, and then transported into the firing-room. The firing-room is a large lofty building lined throughout with sheet iron, and has ventilators; in the roof and the windows are apertures, capable of being immediately closed, with iron shutters arranged upon the same principle as the Venetian blind. The barrels are arranged upon a grooved rack, and fired by a train of gunpowder which connects the breech vents with each other. The train is fired by a percussion cap, which is detonated by a hammer working on a pivot and pulled from the outside; the door is of iron, and it and the shutters are closed before firing. The method of firing and arranging the barrels will be better understood from the annexed diagram, showing the interior of the firing-room whilst the barrels are being proved. After the train is fired the doors and shutters are opened, and the smoke allowed to clear off, and the barrels may be seen then partially buried in a sand heap behind the rack; the bullets are shot into the sand heap on the other side of the room. The barrels are then collected, and those that have through any cause missed fire, are re-primed and again placed on the rack; the other barrels are conveyed to the inspecting rooms, where they are washed out, inspected, and, if found perfect, marked according to the Proof Act. The barrels, however, have previously to stand the hot-water test, which consists in plugging the muzzle with a lead stopper, filling the barrel with boiling water, stopping the breech with a similar plug, and striking it with a hammer, so that the water being compressed exerts an internal pressure upon the barrels, and if there be any flaw or minute hole it will force its way through. Common barrels have to stand for twenty-four hours before being cleaned or looked over, so that if

any flaws are in the barrels the action of the acid residue from the powder will eat into them, and make them more apparent.

The plan of proving described is provisional proof, when the barrels are in tubes; for definite proof, when the barrels are together, and have the breech-actions attached, each barrel is fired separately. The guns when

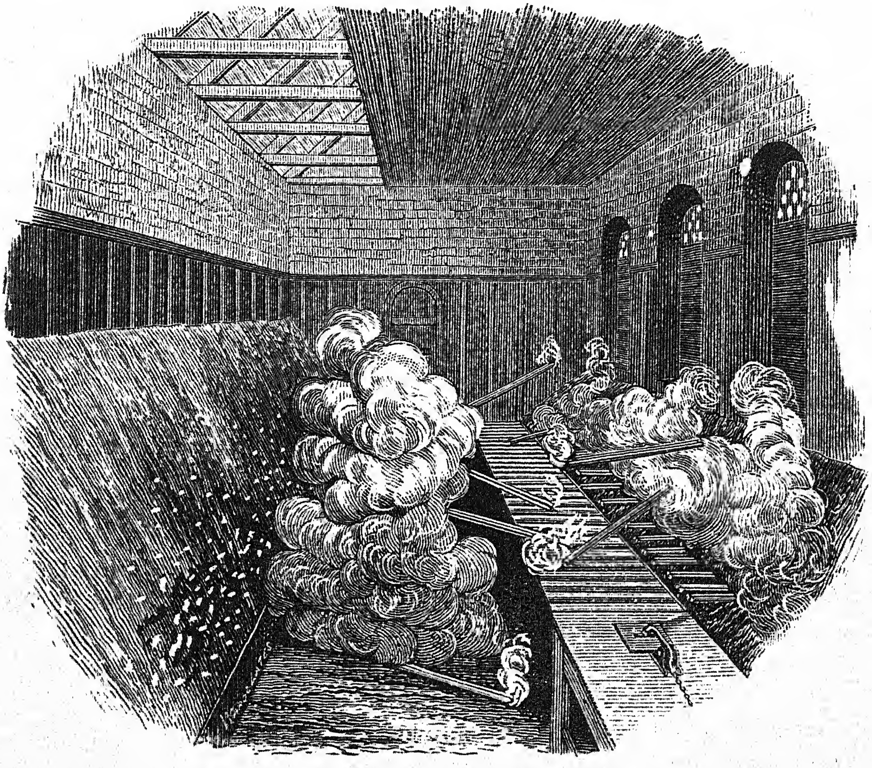


Fig. 205.—Proving Gun Barrels at Birmingham.

loaded are taken to the lobby of the firing-room, and one gun is taken into the room and proved at a time; the barrels and breech-actions are fixed upon and fastened to a travelling block of the required shape, and fired by means of hammers dropping upon a striker which strikes the cap in the cartridge. The hammer is pulled by a cord passing through a hole

in the wall. Various shaped blocks are provided to suit the various sized and differently constructed single rifle breech-actions. Should any flaws or defects be discovered after proving the barrels, they are returned to the maker, who remedies them as he best can, and returns them for proof. Best barrels are frequently burst at proof, but they are more often bulged, in which case the bulges are knocked down by the maker, and the barrel re-proved until it either bursts or stands proof. We have heard that in one case a barrel was proved and bulged eight times, but that it stood all right after being proved the ninth time. In the definite proof the weak breech-actions are frequently blown to pieces, or else made to gape at breech, in which case the maker hammers the false breech till close, and case-hardens it, and when again proved it generally stands. The proving of breech-actions is very necessary, as it prevents, in a great measure, dangerous common breech-actions being sold. In the United States, France, Germany, and Holland, no proof-house exists, and we believe it is only in London, Birmingham and Liège, that barrels are compelled to be proved by Act of Parliament. All small-arms bearing the Belgian proof mark may be sold and used in England without being re-proved, provided they do not bear the name of any English maker. The Gun Barrel Proof Act does not extend to Ireland, Scotland, or the Colonies.

BELGIAN GUN BARREL PROOF.

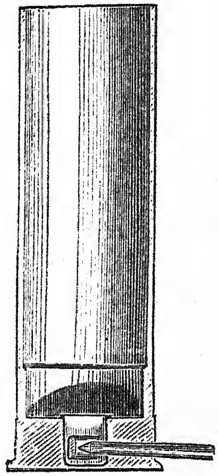
At the Liège Proof House each breech-loading gun is proved three times—first the barrel only, then the barrel and action, lastly the finished gun. The Belgian proof marks are as follows :—

The charges for a double 12-bore gun are—first proof, 22 grammes (339 grs.) powder; second proof, 15 grammes (276 grs.); third proof, 7 grammes (108 grs., or about 4 drachms) of powder. The bullet weighs for each proof 34 grammes (525 grs.). Choke-bores are proved with shot, the charge weighing same as the bullet.

The total cost of proving is only 7½d. per barrel; choke-bore barrels cost 1 centime more each proof. Our prices for choke-bores (only two proofs) amounts to 1s. per barrel.

CARTRIDGES.

CARTRIDGES were probably invented by the French, who used to wrap up the powder and bullet in paper to enable the soldiers to load quickly and dispense with the cumbrous powder horn. The first mention we find concerning cartridges in England is in 1777, when one William Rawle patented several "instruments for carrying soldiers' cartridges," which consisted of cartridge boxes having numerous divisions. The military cartridges were tied round at each end with string, and the end that contained the powder had to be bitten off and the powder poured down the barrel, and the bullet and paper rammed down, the paper thus serving as a wad or patch. In 1827 a patent was obtained for a wire-shot cartridge by Joshua Jenour; the cartridge was made from woven wire with meshes so wide as to allow the shot to be scattered. In 1828 Edward Orson patented a shot cartridge made in two parts, so that the powder might be easily separated from the shot, cases made to break on issuing from the barrel, and so scatter the shots. Augustus Demondion in 1831 patented a breech-loader (page 114) and cartridge for the same. The cartridge had a tube containing detonating powder projecting from its base. It was exploded by a hammer attached to the end of the mainspring, and striking upwards. We give an illustration of this cartridge, which we believe was the first cartridge made that contained its own ignition. Another cartridge was patented in the same year by the Marquis of Clanricarde. The cartridge consisted of many sections of a cylinder so united as to form a cylinder. These were intended to be scattered when fired, and the barrel was made bell-mouthed for that purpose. In 1831 a similar cartridge to that used in the Prussian needle-



SECTION OF PIN CARTRIDGE CASE.

Fig. 206.
The Lefaucheux Cartridge.

gun was patented in England by Abraham Adolphe Moser; this cartridge had the detonating powder attached to the wad placed between the bullet and in front of the powder. This cartridge was first used in a needle-gun loaded from the muzzle, the breech-loading needle-gun not being invented till 1838. M. Lefaucheux in 1836 invented a breech-loading gun and cartridge. The cartridge shown in Fig. 206 is of paper with a metal base; the cap was placed in a chamber with its cup end pointing upwards. A loose brass rod projected from the cup of the caps upwards through the cartridge case, and was struck by the hammer and driven down into the cap, thus causing the discharge; see also Fig. 206. From this cartridge may be dated the success of the modern breech-loader; for, by the expanding at the moment of discharge, escape of gas at the breech is rendered impossible; though, if not well made, or if heavily loaded, they, in common with all pin-fire cartridges, will burst at the pin-hole and allow an escape of gas through it. The cartridge as invented and used by Lefaucheux is still the same as that now commonly used in pin-fire guns.

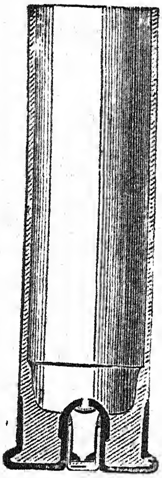
In 1840 the breech-loading needle-gun and cartridge were patented in England; and in the same year Joshua Shaw invented and patented a novel means of exploding the charge in firearms. A small rod or piston is passed through a small cylindrical touch-hole; upon the end of the rod is a cap which is struck through the powder-chamber and exploded against the opposite side, instead of a cap. The ends of the rod may be made hollow, and contain detonating powder; the rods may be kept ready prepared with their caps or powder in the gun-stock or elsewhere. In 1841 Baron L. T. Herterloup patented a continuous priming for muzzle-loading firearms.

Continuous priming, when made of five parts chlorate of potash, one part sulphur, one part charcoal, is liable to ignite beyond the part struck, and may continue to burn like a slow match. Continuous priming which will not ignite beyond the part struck is made by using chlorate of potash by itself, or by mixing forty-five parts of chlorate of potash, one part sulphur, and one part charcoal, all finely powdered. The mixture is put into tubes or other materials about one-tenth of an inch in diameter. Machinery is described for filling the tubes, and rolling them into a flat form, like tape. The continuous priming is rolled up into a coil

and used in that form for discharging firearms; it is placed in a case above the breech, and by self-acting apparatus a swell is projected above the nipple, and is cut off by the hammer just before the percussion takes place.

In this year also, a bullet or projectile was patented by Hanson and Golden that contained in a recess in its base a charge of fulminating powder which served to shoot out the projectile. The discharge was effected by a needle striking against the base of the projectile, and was intended for use in a breech-loading arm. In 1847 a similar method was patented by Stephen Taylor, but he used the ordinary powder, and covered the base of the projectile with a cap provided with a touch or match hole for igniting the charge by means of gun cotton or other explosive matter. The projectiles are to be contained in a magazine consisting of a self-acting feeding-tube, which is attached to the barrel of the piece, and as one projectile is discharged, another is to be pulled forward into the breech of the barrel and fired in succession. In 1852 Robert Adams patented improved ball cartridges: "A metal chamber by preference made of thin sheet copper is affixed to a bullet and wad, and contains the charge of powder. The end of the chamber is closed with paper and other suitable material." In 1852 Mr. Needham's gun and cartridge was introduced and patented; a full description of this cartridge is given, with his gun (Fig. 168). In 1853 a metal cartridge case was patented, made of tin and coated with flock or fibre. In 1854 William Greener patented a metal cartridge case, made of an alloy which melts at a low temperature, as zinc, lead, and bismuth. In 1855 Prince patented a self-consuming cartridge case, for use in his single rifle. It was made of paper steeped in a mixture of nitre and sulphuric acid. In the same year a soft paper cartridge case was patented by John Norton. The cartridge was loaded first with fulminating powder or gun cotton, then powder, and afterwards the projectile. The flash from the cap was sufficient to penetrate the cartridge case and fire the fulminate or cotton, thus obviating the tearing of the cartridge cases. In April, 1853, William Terry patented a cartridge for the Terry rifle. The cartridge is made with a conical bullet having a hollow hemispherical case. It may be enclosed in two or three folds of paper, which are readily pierced by the flash of the cap. A disc of paper is attached to the backs of the cartridge, and behind this a wad is placed, which is left in the piece after the discharge.

In June, 1855, a patent cartridge, chiefly used for revolvers, was patented by Messrs. Samuel Colt and William Eley. The bullet is cast with a rivet and an annular groove at its rear end. The powder-case is formed of sheet foil, and the caps are secured by waterproof cement. The case when charged is attached to the bullet by cement and pressure; a layer of grease is run round the cartridge at the junction of the powder-case and bullet. Central-fire non-consuming cartridge cases were invented in France by A. M. Pottet about 1855, and his system is the one still in general use. In



SECTION OF CENTRAL-FIRE CASE.

Fig. 207.—The "Pottet" Case.

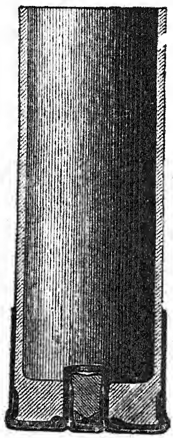


Fig. 207a.—The "Bailey.

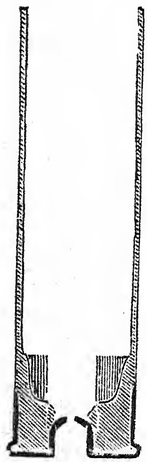


Fig. 208.—The "Daw" Case.

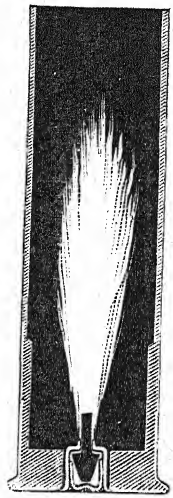


Fig. 208a.—The "Greener" Case, "Sporting Life."

this cartridge (Fig. 207) the base is of metal and the cylinder of coiled paper. The base of the cartridge is filled with hard cardboard, pressed into the case when in a pulpy state. The cap chamber is separate from the base of the case, and is pierced at the point of the dome to allow of the flash reaching the powder. The anvil is shaped like an escutcheon, and is inserted in the cup of the cap, with the point against the detonating powder. Two anvils are more generally used, as they fill up the cap much better and render the ignition more certain. The cap is of copper,

and may be made either with enclosed anvils of brass or the anvils may be separately inserted when re-capping. This case has been improved in the best qualities by inserting in the interior of the cylinder a lining of metal foil, which greatly strengthens the case. The manufacture of this case has been improved since its invention, but the principle and general make of the cartridge are identical with that used by the inventor. A short time afterwards a M. Schneider brought out a modification of the Pottet cartridge, which was at the time considered an improvement, but has since proved not so good. Schneider's cartridge was introduced into this country by Mr. G. H. Daw, and shown by him in the Exhibition of 1862. This cartridge differed from the Pottet cartridge in the form of anvil used. In the Schneider case the anvil is made of a short piece of wire, having four fluted grooves running along it. One end of the wire was inserted in the cap, and the other bore against the dome of the cap chamber. Upon being struck, the flash from the cap passed along the fluted grooves in the anvil, and reached the powder through a hole in the dome of the cap chamber. This cartridge is shown in the accompanying illustration (Fig. 208). It will also be seen that the cap chamber is not riveted to the base of the cartridge as in the Pottet case, and consequently is not so strong. The "Bailey" case, Fig. 207a, designed especially to prevent the escape of gas into the lockwork of hammerless guns, has a brass foil-cap completely covering the base of the cartridge, thinner metal is used in the percussion cap, so miss-fires are guarded against, and the case, though more expensive than the ordinary case, effectually answers its intended purpose. The Greener "Sporting Life" case, Fig. 208a, has the legged anvil, and a perfect ignition gained by use of a large cap, and free access to powder on each side of the square anvil leg. The cap being large, does not blow into the striker hole, and in a properly shaped chamber there is no escape of gas at the breech. It is more particularly essential for "E. C.," and powders requiring at good ignition, but it is suitable for all, except "Schultze" powder.

METAL CARTRIDGES.

Metal cases were used for some years in muzzle-loaders; they were made of very thin foil, and made to blow out of the barrel with the projectile. Projectiles were also made cylindro-conical in form, and con-

taining the propelling charge as already described. Metal cases for breech-loaders seem to have originated with the French. In 1853 Flobert used a copper-bulleted breech-cap for his saloon rifles and pistols, and it is undoubtedly from this idea that metal cartridge cases sprung. Eley next improved upon the plan by filling the copper caps with gunpowder as well as the detonating mixture; but to the Americans is due the honour of bringing the metal cartridge to its present state of perfection. Messrs. Smith and Wesson were the first Americans to use the copper cartridges for their pistols. Gradually the size of the cartridge was increased until it was used for the regulation rifle. Great trouble was experienced in the manufacture of the cases, owing to the great strain upon the metal. Lake Superior copper for the first few years was invariably used; but now brass, owing to its more elastic nature, has been found to be the most suitable metal; it, however, has to be very carefully prepared, and only the best ingredients used.

In England, the first metallic rifle cartridge cases were made from coiled metal foil and covered with paper, and were known as the "Boxer" cartridge; the paper, however, "rucked up" when inserting the cartridge in the chamber of the gun, and has been superseded by coil brass. The base is of iron, and riveted to the coiled cylinder by means of the cap chamber.

THE MANUFACTURE OF CARTRIDGES.

The manufacture of cartridges is a trade apart from gun-making, and has been carried to a high state of perfection. For metal cases, Birmingham stands pre-eminent in England. At the present time there are three manufactories in Birmingham, of which that of Messrs. Kynoch is the largest. At this manufactory several hundreds of machines may be seen at work in the one shop, and cartridges, cartridge cases, caps and ammunition of every description (except powder and shot) made. The metal for the cartridge cases is also mixed and prepared upon the ground. The manufacture of solid-drawn brass cartridge cases is the most interesting branch carried on here, and we will proceed now to describe the various processes. The blanks are first punched from sheet metal. No. 1, Fig. 209, represents full size a blank for a Mauser rifle case. The blank is placed under a drawing machine, and forced by a descending plug through

a tapering aperture, from which it is ejected of the shape shown in No. 2, Fig. 209 ; the thimble is then annealed, cleaned with sulphuric acid, forced through the drawing machine again, from which it issues of the shape

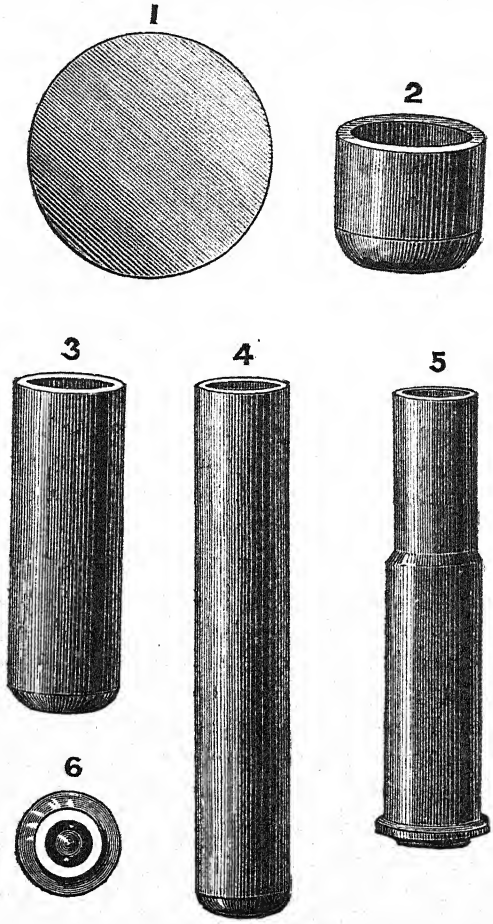


Fig 209.—Cartridge Blanks, Cylinder, and Finished Cartridge.

No. 3, Fig. 209. The processes of annealing, cleansing and drawing have to be repeated several more times, until it is of the dimensions and appearance of No. 4, Fig. 209. The cap chamber is then formed by a plug

in a horizontal punching machine. The neck is afterwards contracted in a press, that gives it the bottle-necked appearance as in No. 5, Fig. 209, which represents the finished case. The head and rim of the cartridge case is then formed by quickly forcing it against a die. This is accomplished in a complicated horizontal punching machine having great speed and power. The cartridge case is dropped in the machine and caught upon a steel plug fixed to a heavy piston, which forces the head of the case against the die by a strong elbow-joint motion; the form is then given to the head or base of the case, as No. 6 in Fig. 209, and is all accomplished in one blow. The flash holes in the cap chamber are then pierced, which operation is shown completed in No. 6, Fig. 209. The case is then cut off to the required length, the rim of the case turned, and it is ready for the cap or primer. In the Mauser cartridge case the anvil is left solid in the cap chamber; but in most sporting cartridge cases the anvil or anvils are separate from the case, and formed as hereafter described.

The cartridge cases, after thus being reversed, are placed upside down and forced into the chamber by a descending rammer; the cases being primed are ejected from the wheel by an ascending plug, and are ready for loading.

The metallic caps or primers are made from copper blanks pierced from rolled sheet metal, and formed into a small cup or thimble. For priming they are placed in an indented plate, and this plate is covered with two other plates having holes drilled through them to coincide with the position of the caps when the three plates are fixed upon the loading frame. The top plate slides horizontally about one-eighth of an inch; that causes the holes in it to move clear of the holes in the bottom plate, which thus forms a bottom to the holes in the top plate. The detonating mixture, whilst quite damp, is carefully spread over the top plate, and the holes in it are filled when in this position. The surplus powder is brushed off with velvet. The top plate is then moved until the holes correspond with those of the bottom plate and the caps, when the charge of detonating powder falls through into the caps. The caps thus charged are removed to a press, and a tightly-fitting tinfoil disc pressed upon the charge of detonating powder, which, in some cases, is afterwards varnished over with a thick coating of spirit varnish, and

thus rendered thoroughly waterproof, and capable of being soaked for seven or eight days in water without any deterioration.

Cap filling is a dangerous process, and is considered so dangerous that by Act of Parliament only one person is allowed in the priming room, as is also the same case in making up the detonating mixture. Muzzle-loading caps are pierced from sheet copper, and swedged into the required cap form at one operation. The machine first cuts the blank either a square, a cross, or star-shaped, and forces the blank through a tapered orifice, from which it issues perfectly shaped and ready for priming. Fluted caps are made in the same manner at one operation Best caps are ground upon the edges after they are formed, and military caps have flanges upon them. By improved machines, military caps are now turned out flanged and shaped at one operation.

Paper cartridge cases, as now commonly used in shot-guns and old-fashioned rifles, have solid brass-drawn bases, which are manufactured from blanks, as already described in the drawing of solid brass rifle-cartridge cases. The paper is coiled round a quickly revolving mandril whilst damp, and covered with paste; the tubes of paper are then dried. The paper tube and the metal base have to be joined; this is done in a press; the paper tubes are first inserted in the open metal base, and a quantity of cardboard pulp placed in the cartridge. A swedge is then pressed over the outside of the case, and a plug descends with considerable force into the inside and compresses the pulp, and spreads it firmly and evenly over the base. The case is allowed to stand until dry, when the pulp becoming hard forms an effectual wedge in the base of the Taper case, and prevents the brass base and paper tube from coming apart.

In some cases the cap chamber is separate from the base of the case. It is made of brass, and is of such a shape as to firmly bind the paper and metal cartridge cases together when riveted in its place.

The cartridge cases are glazed by burnishing them whilst hot and running in a lathe. Occasionally they are varnished, but almost as fine a gloss may be obtained in the process of glazing by heat.

MANUFACTURE OF BULLETS.

Bullets when required in quantities are made by machinery, not cast. The lead is carefully prepared and mixed with zinc or tin to harden it. The

alloy is then rolled out into long round "ropes" of metal, which are coiled and placed upon a rotating vertical spindle of the bullet-making machine. The best machines are self-feeding, cut off the proper length of metal, shape it into a bullet, and eject into a box. The machine cuts off the lead and forces it into a die with a conoidal punch, thus forming the bullet at one blow. When taken from the machine the bullets are "regulated" in a press to ensure a perfect cylindrical form. Each bullet is then placed in a rapidly revolving lathe and wrapped with the paper patch, which is cut off and twisted whilst revolving. The patches are then waxed on to the bullet, and the whole is ready for use.

Bullets so made are much more uniform in weight and shape than cast bullets, there being no possibility of air-holes or rings occurring in or upon the bullets.

WADS.

Wads are punched out of sheets of various materials by cutters fixed in a press. Those most commonly used are made of felts, cardboard, or jute.

The material, especially the felt, is of very varied qualities; the best is hard, tough, and well greased, and will not blow to pieces when used. Common wads are soft and easily compressed, and are blown to pieces immediately they leave the gun.

Pink-edge wads are made from a mixture of felt and paper. In America they are extensively used in place of the true felt wad; but the American pink-edge wad is thicker than ours, and is generally used two together over the powder. Cardboard wads are made of various thicknesses, and may now be obtained with figures printed upon them indicating the number of shot with which the cartridge is loaded.

Very many materials have been used for wads, some of which we mention amongst the miscellaneous inventions relating to gunnery. India-rubber, gutta-percha, cork, leather, linen, cloth, wood, metal, and a variety of other substances, have been several times tried and abandoned. All gunmakers and sportsmen, however, seem agreed that good wadding is required to obtain good shooting.

LOADING CARTRIDGES.

When loaded in large quantities, rifle cartridges may be cheaply and accurately done by machinery. The cases are first placed in frames, 100

in each. The frames are then conveyed to the loading room, where one person fills them with powder. The powder is contained in a magazine affixed to the wall on the outside of the loading room. An india-rubber pipe runs from the magazine into the loading room. The cartridges are placed beneath the pipe, and, by means of an accurately constructed measuring machine affixed to the end of the pipe, the exact charge may be deposited in the cases. The measure is worked with one hand, whilst with the other the loader guides the machine from case to case with such rapidity that 30,000 a day may easily be loaded by one person. The cases when loaded are taken into a separate room, where the wads are introduced and pushed home with hand rammers. We do not know that any steam machine has yet been invented that will successfully ram home the wads without either injuring some of the cases or grinding the powder to dust. When wadded the bullets are placed in the cartridge, pressed home, and the whole cartridge inserted in a swedge, to close in the lip of the case and make it accurately fit, and clip the bullet to prevent it slipping from the cartridge case. Cartridges so made and loaded may be placed under water for a fortnight, and will not be injured or rendered useless.

SHOT CARTRIDGES.

In loading shot cartridges in quantities, most gunmakers make use of the Erskine machine. Our plan is to use the Erskine machine as a tray only to hold the cartridge cases for the insertion of the wads, as we find the methods of measuring both the powder and shot not sufficiently accurate to obtain good and uniform results. In our cartridges the powder is either weighed into the cases, or accurately measured by a machine similar to the one employed in loading military cartridges. The wads are then inserted by using the Erskine machine and rammer. The charge of shot is accurately counted into the cases by a simple and effective machine of our own invention and construction. With this machine it is impossible to obtain anything but the exact number of pellets required in the cartridge. The machine can be so adjusted as to count any number of pellets required.

When loaded with shot, the cartridges are wadded in the Erskine machine, and turned down in a quickly revolving lathe. They are then counted, placed in boxes, packed and labelled.

In loading with the Schultze wood and "E.C." powders, the charges are invariably weighed.

It is absolutely necessary to have a good thickness of wadding between powder and shot if hard shooting is required. We usually load with a black card wad, followed by a felt of $\frac{3}{8}$ in. thickness, and, if there is sufficient room in the case, we place an ordinary card wad over the felt; but this last is not necessary to get good shooting. The thinner the wad over the shot the better. We used the thick felt and pink-edge wad at the gun trial of 1875, and we believe we were the only competitors who used these wads. The other competitors chiefly used a black card, an ordinary felt, followed by a common card wad. The shooting, however, can only be very slightly affected by the wad and loading, regularity and closeness being entirely dependent on very careful boring, the shape and the extent of the choke only being arrived at after much experience. A thoroughly well-bored full-choke gun will shoot well with 3 drs. and $1\frac{1}{8}$ oz. No. 6; and, if $3\frac{1}{4}$ drs. and $1\frac{1}{8}$ oz. is used, it will only shoot more pellets into the *centre*, thus making it a better gun for long ranges.

If $3\frac{1}{4}$ drs. and $1\frac{1}{4}$ oz. to $3\frac{1}{2}$ drs. and $1\frac{1}{4}$ oz. is used, the effect will increase the size of the killing circle, making it a better pigeon gun. The pattern, however, will still be as dense in the middle as with the smaller charge. Load the same gun with $3\frac{1}{4}$ drs. and $1\frac{1}{4}$ oz. No. 5 shots, a smaller killing circle is the result; the pattern, however, is a little better distributed, and almost as dense, there being fewer outside shots.

With 3 drs. and 1 oz. of shot a regular pattern is still obtained, but the killing circle is much smaller. If No. 8 shot is used for snipe, &c., the killing circle is greatly increased; if No. 1 for duck shooting, the killing circle is diminished, but the range greatly increased. Even buck shot to A A A may be advantageously used in a properly constructed choke. Thus it will be seen that a really good shooting gun with one load must necessarily shoot as well in proportion with various loads, and a full-choke-bore gun in the hands of a good shot is undoubtedly the best gun for all purposes.

Modified chokes require more care in construction, and most trouble is experienced in obtaining a really good one, the shooting as a rule being not so reliable, there being numerous very dense and also very thin patterns. Sportsmen cannot attach too much importance to regular and uniform

patterns, especially in pigeon shooting, where one thin pattern will probably cause a shooter to lose a match. Of course, in cheap guns it is impossible for the maker to give the necessary attention to insure the perfect shooting, but at a moderate price we can afford to do it, and even our best prices may be considered moderate compared to those of the chief London makers. As to penetration, we never knew one of our regular shooting guns to fail in this respect, especially when loaded with $3\frac{1}{4}$ drs. and $1\frac{1}{8}$ oz. of No. 5 chilled shot.

BRASS CARTRIDGES.

The Americans, soon after the introduction of small-bore breech-loading rifles for military purposes, improved the shape of the cartridge case by contracting it near the mouth, thus giving it a bottle-necked appearance, and considerably shortening it. This has been carried to the greatest extent in the present military cartridge case adopted by our Government, in which the base of the case tapers to ·577 and the mouth ·450, being a sharp contraction of ·127 inch. This cartridge is still made of coiled brass.

Of the superiority of the solid-drawn brass case there can be no doubt, and we believe that in a few years they will be generally used for military purposes, and much more in favour amongst sportsmen. Too great a contraction is, however, a mistake, and although it gains its object—viz., the shortening of the case—yet it increases the recoil and strain upon the barrel considerably. In our opinion, a nominal ·450 cartridge should not be contracted more than ·075 of an inch. A taper case is the best in all cases where practicable, as for 12- and 8- and 4-bore rifles; but small-bore rifles require a bottle-necked cartridge, or may be a sharp taper case from base to mouth, as in the ·577 Express cartridge. For many years we have been aware of the desirability of a better cartridge case for 12- and 8- and 4-bore rifles: the paper cases are so irregular, and liable with heavy charges to expand in the chamber and become jammed in, as they will not retract—extraction in some cases being exceedingly difficult.

An instance is given by Mr. G. P. Sanderson, who in his work on "The Wild Beasts of India," p. 227, says:—"The elephant at last stopped, and in another moment was swinging round, the picture of rage. . . . I

fired at his shoulder, as he was too unsteady to afford me a certain head shot. There must have been something the matter with my 4-bore, for it kicked most unmercifully, and nearly sent me on my back; but it did more for the elephant, knocking him over like a rabbit. The elephant quickly regained his feet, whilst I endeavoured in haste to withdraw the exploded cartridge of the 4-bore, which was a single barrel by Lang. The heavy charge of powder had so expanded it that I was unable to extract it, whilst the elephant made across to our right. Seizing my 12-bore Greener, I ran to get a side shot. . . . . I admired the conduct of my second gun bearer, who was on his knees at my feet behind the tree, trying with his teeth to extract the 4-bore cartridge."

The solid-drawn brass cartridge-case, after expanding, retracts, owing to the elastic properties of the metal, and will not stick in the chamber after using heavy charges. We have succeeded in introducing to sportsmen solid-drawn brass cases for 12, 10, 8, and 4-bore rifles, and like cases for 8 and 4-bore duck-guns.

These cartridge cases are accurately and carefully made, by large and expensive machinery, in the factory of Mr. Kynoch, and are, without exception, the best brass cases ever offered to sportsmen.

The anvil has an elongated tail that projects through the dome of the cap-chamber into the interior of the cylinder of the cartridge-case. By simply pressing the tail with a common rammer, the cap is ejected. The anvil may be used many times in re-capping the cases, or fresh anvils may be supplied. The cases may be obtained either with or without the indentation, which securely retains the wad or bullet in position.

The advantages of these solid brass cases are manifold, especially to hunters and other sportsmen, who have to journey long distances up country, and where 5,000 or 10,000 cartridge-cases are a considerable burthen and a continual nuisance. In the brass case, the rim being solid it cannot burst; therefore the advantage of these cases for use in weak or worn breech-actions is obvious. The cap being larger, there is no liability of its blowing up the striker-hole, and there is no escape of gas at the cap-hole. A few brass cases may be used many dozen times, and with legged anvils are easily and quickly re-capped, and do not take up a large space, or require cumbrous and complicated re-capping machines. They

are more easily inserted in the chambers of the gun, as ramming in the wads will not bulge them, as is frequently the case with paper cases. They will not become jammed in the chamber after the discharge, as, owing to the elastic nature of the metal, it retracts immediately after the firing. Brass cases have a larger internal bore than paper cases of the same size, and will consequently hold a larger charge or an extra wad: for this reason their value cannot be overrated for pigeon-shooters and professional marksmen. They improve the strength of shooting, and in the end are much cheaper than paper cases. For rifles and guns they have long been used in America, but no good system of re-capping is in use there. The one and two-hole system of re-capping with ever-breaking prickers has prevented them from attaining the success they are destined to gain with this system of re-capping. The anvil is suitable for all sizes of cartridges, from the ·360 rook-rifle to the 4-bore duck or elephant-gun, and is equally efficient in all.

For rifles our brass cases are very advantageous, especially for those of large bore. The outside of the case gauges the same as the paper cases, but the metal being much thinner than the paper the internal diameter is considerably larger than that of the paper case of the same gauge: hence it is possible to have a more powerful rifle, although using the same gauge cartridge. Rifles bored and grooved especially for these brass cases carry a considerably larger and heavier bullet than those of the same gauge rifled for the paper case. For instance:—

The 12-bore bullet	for the	brass	cases	weighs	635 grs.;	for the	12-gauge	paper-case,	605 grs.
,, 10-bore	,,	,,	,,	,,	810 grs.;	,,	10-gauge	,,	686 grs.
,, 8-bore	,,	,,	,,	,,	980 grs.;	,,	8-gauge	,,	872 grs.
,, 4-bore	,,	,,	,,	,,	1,510 grs.;	,,	4-gauge	,,	1,300 grs.

It will thus be seen that there is a difference of 35 grs. between a 12-bore rifle-bullet for the brass case and one for the paper case. This makes the 12-bore rifle with the brass case nearly equal to a 10-bore rifle with the paper case.

The so-called 8- and 4-bore rifles with the paper cases are really only 9- and 6-bores respectively; the bullets weighing 872 and 1,300 grs. only.

The introduction of these brass cases has, therefore, caused a larger and more effective breech-loader to come into use than was ever made

with paper cases, for instead of a 4-bore rifle-bullet weighing 1,300 grs. only, it can now be made to weigh 1,510 grs.; thus creating a far more powerful weapon for large and dangerous game, the importance of which cannot be over-estimated by experienced sportsmen.

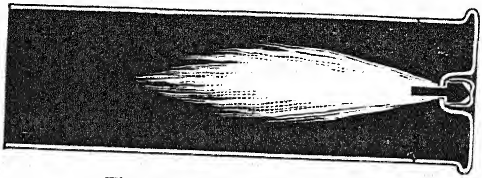


Fig. 209a.—The Perfect Case.

Thin drawn brass cases are now made by several firms. The first introduced is shown in Fig. 209a, but it is not all that its name implies. It consists of a solid drawn brass case of thinnest metal, which is reinforced by a cap over the base, a legged anvil is used, and the cases are made of every size from ·360 to 4-bore. Their chief faults, all of which may be remedied by more careful and improved manufacture, are irregular rims, weak bases, and faulty cap chambers. The metal at the base being very thin and elastic, the cap when struck by the striker is not rigidly supported by the anvil, the base cap chamber, anvil cap and all bilging in, and miss-fires result; more sensitive caps have been tried, but not with entire success, and Mr. Kynoch is still experimenting towards remedying all the defects that have been proved, and possibly future issues will not belie their name.

Messrs. Eley also have their thin brass cases, but as yet do not make them of every size, and to make matters more confusing, mark each case with two gauges as 10-12, 12-14, &c. They are a superior and more expensive case than the "Perfect," and have a paper pulp pressed into the base to make it rigid. They are solid brass-drawn, without reinforcement, and take the usual Eley cap and anvil. Other makers, home and continental, make these brass cases, and in all probability they will eventually supersede paper cases for every purpose.

Wads are held in these thin brass cases by corrugating the end after loading. The machine for producing this crimping was invented by the author, and will be described later on, as also the improved shooting obtainable from brass cases.

MANUFACTURE OF GUNPOWDER.

We have already given a short history of gunpowder in the dark ages; but little interest is attached to the formation of this compound until it was manufactured in Europe. Previous to the reign of Queen Elizabeth nearly all the gunpowder used in England was imported from abroad. Flanders, Spain and Germany being the earliest countries to commence its manufacture upon an extensive scale. In England, in 1561, a John Tornworth was in treaty on behalf of Queen Elizabeth for the purchase of "saltpetre, sulphur, and bowstaves;" in 1588 license was granted to some of the Evelyn family to "digg and worke for saltpeter within the realme of England and Ireland, during the term of eleven years." A few years later we find three of the same family possessed of a Government monopoly for the manufacture of gunpowder in the south of England, From 1650 the notices of English gunpowder works are of frequent occurrence, and the various mills and processes are described, including the manufacture of an explosive compound from sulphur, stones and alcohol, and the "mixing of refined sugar with the powder." According to these chronicles, corporating mills, stamping mills, corning mills, and solar stoves for drying the powder, were in use. The ingredients were mixed in various quantities, but it appears that the ingredients saltpetre, sulphur and charcoal, have been almost invariably used conjointly. We will now describe the process of manufacturing gunpowder as at the present time carried on in the great mills of England and Scotland.

In the leading mills the ingredients for the manufacture of gunpowder are supplied in the rough state, and are there refined and prepared for use. This course has been found to be the only one by which uniformity of results and pure finished powder can be obtained. It is also a more perfect safeguard from accidents, for where the ingredients are received refined, ready for mixing, particles of grit introduced after refining may cause deplorable explosions during the corporating process.

Saltpetre, or nitre, the chief ingredient of gunpowder, is a chemical compound of nitric acid and potash. In some parts of the world—in India and Andalusia especially—it is formed as a natural efflorescence upon the sur-

face of the earth, and is indeed the only source from which we derive it. In Prussia, France, Sweden, &c., the old mortar used in building the farm walls is so treated as to produce saltpetre. Nitrate of soda (cubical nitre) is also largely imported into England for the manufacture of artificial saltpetre. The Royal Waltham mills derive their supply entirely from Bengal and Oude. The salt is collected, boiled with water, and the solution, after being concentrated by the heat of the sun and evaporated, yields impure crystals, which are packed in coarse bags, and shipped to England; in this state the salt is known as "grough" saltpetre. Upon arriving at the powder-mills the saltpetre is refined by the following process:—In a large vat, capable of holding about 500 gallons of water, is placed two tons of grough saltpetre, and the fire lighted underneath, after adding about 275 gallons of pure water to it. In about two hours' time the saltpetre is in solution and boiling; the specific gravity being 1·49, and the temperature approaching 230° Fahrenheit. The scum, containing the greater part of the organic impurities, is removed from the surface, until no more scum rises; the copper is then filled up with cold water and boiled briskly for a few minutes, and allowed to cool down to 220° Fahr., when it is pumped into filters, and the hot solution run off into shallow vats to crystallise. As the temperature falls the excess of saltpetre crystallises out, leaving a considerable quantity still in solution, which also retains the chlorides, sulphates, and other chemical impurities. Whilst in the vats the solution is continually agitated to prevent it from forming into large crystals, the salt by this means is deposited in the form of flour. The flour is then washed three times, tested, and if pure, is ready for use.

Sulphur, another of the ingredients of gunpowder, is one of the few simple non-metallic bodies which exist in a natural state uncombined. In all volcanic countries it is very abundant. In Sicily it is found embedded in thick masses nearly pure, and it is from this island that we chiefly derive our supply. The sulphur, upon arrival at the powder-mills, must first be refined. The old way is to simply fuse the sulphur, when the grosser impurities sinking to the bottom and the lighter ones rising to the surface, leave the intermediate sulphur more or less pure, and it was then drawn off by a suitable contrivance. At the present day sulphur is refined by two methods, distillation and sublimation. Distilled sulphur,

chiefly used in the manufacture of gunpowder, consists of masses of clear yellow crystals in the form of rhombic octahedra, and is soluble in bisulphide of carbon. Sublimed sulphur is the common flower of sulphur, and as it is but seldom used as an ingredient for gunpowder calls for no special notice.

The process of distillation consists of heating the grough sulphur in an iron refining-pot, having two pipes leading from it, one into a subliming dome, the other into a collecting-pot, until it vapourises. The vapour at first is of a pale yellow colour, this passes into the subliming dome, and is immediately precipitated into an insoluble electro-positive form known as flower of sulphur. Upon the vapour becoming more dense and of a darker hue, the pipe to the dome is stopped, and the one to the receiver opened. This pipe is surrounded by a water jacketing, and kept constantly cool by a running stream of water; upon entering this pipe the vapour is condensed, and runs into the receiver in a liquid state, of the consistency of treacle, which it strongly resembles. When sufficiently cool it is ladled out into wooden tubs, and allowed to solidify. When "set," the tubs are knocked off from the sulphur, which is broken up and placed under a mill, and well ground until it will pass through a 32-mesh wire cloth—when it is ready for use.

There is, practically, no loss in refining sulphur, but care has to be taken that the temperature of the melted sulphur be not allowed to rise to 836° F., as the vapours given off at that heat are highly explosive when mixed with common air, so that if, through the leakage of a pipe or other cause, the air is allowed to come into contact with the vapour an explosion invariably occurs. Professor Bloxham says: "Sulphur as an ingredient of gunpowder is valuable on account of the low temperature (560° F.) at which it inflames, thus facilitating the ignition of the powder. Its oxidation by saltpetre appears also to be attended with the production of a higher temperature than is obtained with charcoal, which would have the effect of accelerating the combustion and of increasing by expansion the volume of gas evolved." Sulphur melts at a comparatively low temperature of 239°, vapourises at about 270°, and inflames at 560° F.

The third and last ingredient of gunpowder, charcoal, is manufactured from either of the following woods:—Willow (*Salix alba*), Alder (*Alnus glutinosa*), or what is known in England as Black Dog Wood (*Rhamnus*

frangula), although any light, soft wood may be used. In India the Grambush plant (*Cythus cajan*), Parkinsonia, and Milk-edge (*Euphorbia tiraculli*), have been found very suitable. The wood is generally cut in the spring, in order that it may be the more easily stripped of the bark, but wood felled in the fall or winter is equally as good, providing that it is carefully decorticated. The removal of the bark is compulsory, as it prevents scintillation, which would prove a very dangerous quality in gunpowder. At most of the mills large quantities of willow are grown upon the ground, but a good supply, especially of dogwood, is derived from Prussia and other continental countries. The process of charcoal-burning is as follows, and ensures perfectly fine and pure charcoal:—The wood, in lengths of about 3 feet, and from 1 to 4 inches in diameter, is placed in an iron cylinder or retort, several of which are set in the flues of a large furnace; pipes lead from the retorts to the furnace for the exit of the noxious vapours. The time taken for the proper charring of the wood depends entirely upon the heat of the furnaces and the thickness of the wood. Charcoal made at a temperature of 500° F. is readily ignited at 640° F., whilst charcoal made at 1800° F. requires nearly double the temperature of the last to influence it; for this reason the charcoal made at a low temperature is considered the best for sporting purposes; it, if properly burnt and from the best wood, is, when powdered, of a reddish-brown hue; whilst the latter, being denser and consequently less hygroscopic, is of a black colour. When sufficiently burnt, the retorts are raised, and lowered into extinguishers, in which they remain for several hours, after which the charcoal is shot into coolers, and subsequently ground to powder and stored for use. Great care is required in the burning of charcoal; and if uniform results are required from the powder, it is essential that the retorts be kept always at the same temperature; to ensure this, pyrometers are used in some mills, but the Government depend upon the care and watchfulness of the foremen. Freshly-powdered charcoal is never used to make gunpowder, as it is liable to spontaneous combustion, and generates great heat. After standing ten or twelve days it loses this property, and may be safely used. The ingredients being now prepared, they are mixed in the mixing-room. The quantities are weighed out and roughly mixed with a shovel, and placed for a few minutes in a rotating drum making 40 revolutions in the minute. The bearings of

the drum are hollow, to enable an axis carrying 44 arms or fliers to revolve at twice the speed of the drum in the opposite direction. The charge, consisting generally of 60 lbs., is usually made up as follows:—75 per cent. saltpetre, 15 per cent. pure charcoal, and 10 per cent. sulphur; the saltpetre being always mixed in a damp state 1 lb. is added to the 100 parts to cover loss in manufacture; when mixed, the compound is called a green charge; although not so inflammable as gunpowder, it is of course explosive, and when accidents do occur in the mixing-shed—happily but a rare occurrence—the victims are generally found to be more burnt than those who are killed by the explosion of gunpowder, from the slower and more lasting nature of the flame.

The process of mixing is in some mills dispensed with entirely, the incorporating mills being made to do the work of the drum, but it causes more waste. The next process, that of incorporation, consists of a long-continued trituration beneath heavy runners, by which means the mass of ingredients becomes transformed from a mere mixture of three different substances into gunpowder. This is the most important process in the manufacture, and no subsequent care can possibly improve the quality of the powder.

The incorporating is effected by grinding the mixed ingredients for several hours beneath heavy runners. The bed of the mill is of iron, or of stone with iron *tuyères*. The runners weigh from 3 to 4 tons each, and vary in size from 3½ to 7 feet in diameter, the smaller ones creating less friction upon the bed whilst revolving round the vertical spindles are considered the safest. Iron runners and beds were first used in Scotland in 1804; the mills, formerly turned by a horse and gear, are now worked by steam or water power. The incorporating is one of the most dangerous processes; unavoidable accidents, arising from unknown causes, frequently destroy the sheds and machinery. A cistern containing 40 gallons of water is poised upon a support immediately over the runners; the cisterns in the various mills are connected to each other, so that upon an explosion in one mill all the cisterns empty themselves automatically, thus the powder under the various runners is at once rendered non-explosive. The sheds themselves are made with strong wood frames covered with light boarding or felt, so that in the case of an explosion the damage caused is comparatively trifling. The charges are placed in the mill moist, and require watering

from time to time; this is done either automatically by machinery, or by the hand. The charge requires to be under the runners 10 to 12 hours for best sporting gunpowder. In the Government mills, however, 3½ hours is considered sufficient for cannon powder, and 5½ for small-arm powder; with heavier runners, making 8 revolutions a minute,—it is not even left so long.

The mills fortunately require but little attention, consequently the explosions rarely cause a loss of life, the machinery only requiring inspection occasionally, and the charge prevented from sticking to the runners.

The greatest danger is at the moment of starting, and by Act of Parliament 60 lbs. is the maximum charge allowed to be incorporated in one mill. The object, of course, is to prevent accidents if possible; but it is doubtful if a 100 lb. charge would not be more safe, as it would possibly prevent the two runners from coming into contact with the surface of the bed, which occasions considerable friction, and is the cause to which most of the accidents are assigned. After incorporation the powder, known in this state as *mill cake*, must be reduced to a meal between rollers, in order to prepare it for pressing. This process, known as "breaking down," is not a primary operation in the manufacture, but only a preparatory measure adopted to ensure perfect pressing. The meal must not stand for any length of time, but be at once conveyed to the press-room, and subjected to hydraulic pressure. Formerly this pressure was dispensed with, and we believe that powder made in this way is still current in some parts of Great Britain, Spain, and most Eastern countries. The pressure gives consistency to the grains, increases the density of the mixture, and prevents the finished material from crumbling to dust during transit or loading. The meal is placed in the press in layers, the layers being separated by felt or canvas and gun-metal sheets. When loaded, the press is subjected to about seventy tons pressure to the square foot—more or less, according to the density of the powder required. When unloaded the powder is in slabs varying from ¾ in. to 1½ ins. in thickness. Pressing is a most important process, and it is of the greatest importance that the density obtained should be uniform. A difference of ·05 in the specific gravity of the charges may affect the velocity of a 12-lb. shot, fired with a 1-lb. charge, to the extent of about fifty feet per second. No difference between the powders may be perceptible until weighed, and therefore it has frequently

happened that the fault which lay in the powder has been attributed to the weapon or projectile. After pressing, the slabs are broken up into fragments with mallets, and sent to the granulating shed. The process of granulating or corning consists in reducing the fragments of press cake into various-shaped grains of the required sizes. In private manufactories, where all sizes of grain are required, the process is more simple than in manufacturing Government powder of one specified size; consequently, in the latter case there is much more waste. The old corning machine consisted of a large revolving rectangular wooden frame, on which were placed a number of sieves with parchment covers, and on the axis of each was a loosely-fitting disc of *lignum vitæ*. During the rotation the discs dashing about in the sieves broke up the cake, but created a great quantity of waste and dust, besides being highly dangerous. The Congreve machine is now almost universally employed. It is a complicated machine, the cake passing between toothed gun-metal rollers fixed at various distances from each other; the teeth are of various shapes and sizes, and the machines are made self-feeding. The process of corning is a dangerous and dirty one. As may be expected, the amount of dust created is enormous; fans are at work in the shed to collect it, and blanket screens are also requisite. Even with these appliances the dust pervades the atmosphere to such an extent as to render a long stay in the shed impossible. The whole shed from ceiling to floor is covered with the dust, and the workmen are as black as any colliers, but they are, it is stated, very healthy. The thickness and prevalence of the dust renders isolation of the corning-shed necessary, as, if an explosion occurred and the corning-house were adjoining, nothing could prevent a general conflagration. During the process the powder is sifted to a certain extent, and the useless material and dust collected, and either re-pressed, or re-incorporated and pressed, according to the quality of the refuse.

The next process is to sort the powder by sifting, and free it from dust or minute particles of matter that may have been obtained in the corning-house. The powder is freed from dust by placing it in revolving reels covered with cloth or wire mesh, through which the dust escapes. It is then sifted in rotating wire cylinders. The next process is to glaze or polish the individual grains; this is accomplished by causing the grains to rub against each other in revolving wooden barrels or drums. Dense hard powder will take a higher glaze than the softer kinds, for it is clear that poorly pressed or

soft gunpowder cannot stand much knocking about in the sieves or churns without becoming disintegrated and forming fresh dust. Higher-glazed and harder-grained powder will resist damp much better than soft kinds. Blacklead (graphite) is placed in the churns with the common powders to give a fine glaze in a short time, but this practice is detrimental to the quality of the powder, causing the gun barrel to foul much quicker, and leaving a greater residue. The dusting-reel is formed with twenty-four-mesh canvas, and makes about forty revolutions per minute. The glazing takes from five to eight hours, in wooden barrels revolving thirty-four times per minute. The powder is then subjected to a second dusting, same as the first, and must then be stoved. The friction in glazing necessarily engenders a good deal of heat; some of the finer-grained powders are so hot as hardly to permit of the hand being plunged in. In every case the heat is sufficient to make the powder give off nearly all its moisture, but as there is no escape for it, it condenses in the interior of the barrels, and forms a hard coating with the powder dust. The stoving consists in subjecting the powder to a temperature of 125° or 130° Fahr. for eighteen or more hours. The powder is placed on canvas-bottomed trays, and arranged on racks in the stoving-room, which is heated by steam coils fed from a boiler some distance off. The stoving sweats the powder, and drives off any remaining moisture. After stoving, all that the powder requires is "finishing" by again revolving it in a drum: it may then be sifted and stored in the magazines. Owing to the stringent Acts of Parliament, and the dangerous nature of the work, the manufacture of powder is an expensive undertaking. The distances from the various sheds are so great as to require extensive grounds. To be profitable, water power is indispensable. At the mills of Messrs. Pigou, Wilks and Laurence, at Dartford, nearly all the sheds are placed at the water's edge; this cheapens the cost of manufacture, and lessens the risk of explosion, for all the carrying of the ingredients and the powder in its various stages is done by boats propelled through the shallow water by one man. Every care is taken, and all proper precautions enforced, to prevent accidents. The engines, boilers, furnaces, &c., are at considerable distances from the various sheds, the keyed shafting running in some cases over a hundred yards through the bushes. At the above mills all the processes described are carried on. The ground being planted with alder and dogwood, the Company produce

a great quantity of the wood used for their own charcoal. They do their own refining, make the canisters and kegs upon the premises, and manufacture their own gas, in order that work may be carried on in the incorporating mills as advantageously by night as by day. The packing, sorting and labelling are mere matters of detail, chiefly performed by females and requiring no particular mention. Accidents in the packing-room are of rare occurrence, but generally severe and fatal when they happen. In the incorporating mills, corning and pressing-houses, the glazing-room and stoves, the floors are laid with leather, and felt or sewn leather over-shoes must be worn. They are put on immediately before entering, and left at the door upon coming out, so that they never come into contact with grit of any description.

The testing and proper mixing of the gunpowders are worthy of a fuller mention in another chapter, but we will here state that Messrs. Pigou, Wilks and Laurence have at their extensive factory a large room for weighing and testing the powder, and have a range and Boulèngé's chronograph for experiments, and ensuring only uniform powder being produced.

PEBBLE GUNPOWDER.

Large-grain gunpowder for cannon was advocated by the late W. Greener in 1858, who loudly complained that the largest-grained powder then made was not half large enough for the 9-inch cannon ; it was, however, nearly ten years later when the English Government agreed to adopt it, and three years after this, machinery was laid down for its manufacture at Waltham Abbey. The Russians, it is believed, were the first to make a powder of this class. The Belgians followed with a gunpowder cylindrical in form. Pebble gunpowder consists of (1) regular-sized cubes of gunpowder, (2) of prismatic gunpowder, in which the grains are shaped like six-sided prisms perforated with holes. The first kind is made by cutting the *press cake,* with special machinery, into the required size.

The prismatic grains are formed by pressing either the mill cake, or corned powder in moulds, with a plug or plunger worked by screw or hydraulic pressure ; the prisms are one inch in height, and this and pebble powder are shown in Fig. 210. By pressing the powder into blocks or prisms from the mill cake, a uniform density is obtained ; each prism of

powder is usually subjected to a pressure of 1,000 lbs. for 10 or 20 seconds. With the introduction of large cannon a larger-grained powder has been required. This powder (called giant cube,) is made in the same way as other pebble powder, each grain being nearly a two-inch cube. All pebble and prismatic powders require glazing: this is done in the usual manner—friction against each other in a revolving barrel. Graphite in all cases is used, it protects the grains from damp and more readily effects a glaze; it also retards the combustion, a point desired for use in large cannon.

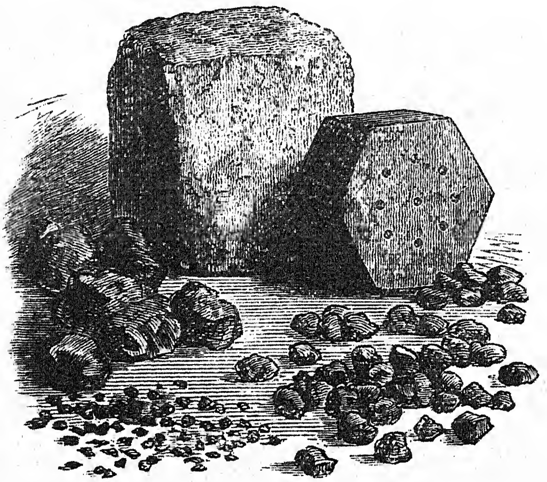


Fig. 210.—Pebble, Cube, Prismatic, Ordnance, and Military Rifle Powder.

MODERN EXPLOSIVES.

We will now treat of various modern explosives known by the high-sounding appellations of nitro-glycerine, gun-cotton, litho-fracteur, mataziette, dynamite, glonoine, tonite, cotton-powder, dualine, glyoxiline, saxafragine, and blasting gelatine. Most of these compounds are of recent origin, and to the general reader it seems an endless task to keep pace with ever-increasing new-fangled explosives; in fact, it appears useless for an ordinarily-constituted mind to become acquainted with the qualities and nature of these explosives, for no sooner is one understood, than another, with a more incomprehensible name than the preceding

ones, springs into existence. But in reality the only mystery in connection with them is their names; all are, roughly speaking, the produce of the one substance, that is to say, they are one and all nitro-compounds. Some, indeed, are liquid, others solid, some pure, some mixed, but all springing from the same basis—nitric acid. *Gun-cotton* is a nitro-compound in a solid form; it is obtained by steeping cotton, or, as chemists say, cellulose, into strong nitric acid, but more usually a solution of nitric and sulphuric acid is employed. The cellulose contains a certain amount of carbon and hydrogen. During the bath the latter is removed by the oxidising effect of the nitric acid, and replaced by three equivalents of nitric pyroxide, producing a substance known as tri-nitro cellulose or gun-cotton. The substance is to all appearance of the same nature as when placed in the bath, but its constitution has entirely changed. It is washed to cleanse it from acid and other impurities, and may be stored in that form or mixed with other ingredients. Schönbein was the first to manufacture gun-cotton about 1846, but starch had been employed and treated in the same manner some years previously. *Cotton-powder* is merely gun-cotton reduced to a powder, and *Tonite* the same body mixed with nitrates or similar chemical bodies. Gun-cotton cannot by any process yet known be deprived of its explosive properties without destroying the compound by fire. Many years ago a large quantity of gun-cotton of extra strength was manufactured, and ordered to be made away with; some was sunk at sea, some burned, and some buried in the marshes of Faversham. The latter is occasionally met with in excavating, and upon trial has been found not to have lost in the least its fierce strength. Unconfined gun-cotton will burn quietly if ignited with a flame; if ignited by percussion the effect is as great as though confined. For submarine and war purposes gun-cotton is at present stored in a wet or damp state, and may be used and its full strength employed when in this condition. This is effected by the simple expedient of first discharging a small quantity of dry gun-cotton, called a "primer," by percussion. The primer must come into immediate contact with the wet cotton, which it will cause to explode with its full violence.

Gun-cotton as at first manufactured was so fierce and ungovernable in its action as to render it useless for military or sporting powders. The processes of taming gun-cotton, though not numerous, must be thoroughly carried out. The first samples of gun-cotton, or a like material called cotton-

wool, are so rapid in action that they may be exploded in contact with ordinary gunpowder, and will not even set fire to it. By the more perfect washing of the material, and freeing it from acids (the presence of which renders it exceeding unstable), its results have been rendered more governable. Gun-cotton as used by the British Government is reduced to a pulp, and in this state freed from all impurities; it is then pressed into slabs or moulds of any required shape, and appears in that state to resemble *papier maché* blocks more than cotton. These blocks of compressed cotton burn freely when ignited, but do not explode with violence unless confined or fired by detonation.

The important part to be played by gun-cotton and other nitro-compounds in future wars will be watched with great interest by all scientific persons; a substance that may be stowed in a small compass and fired with the most disastrous results, either upon land or water, cannot but change the present system of warfare. For torpedo boats, and all submarine and subterraneous works, it has a great advantage over gunpowder, on account of its not becoming deteriorated by damp or atmospheric changes. The terrific violence of a heavy charge of gun-cotton exploded under water greatly exceeds anything likely to be obtained by gunpowder. A charge of 450 lbs. of gun-cotton sunk beneath the surface will throw a cone of water 60 feet in height, with a base of 220 feet (see Fig. 211). No ship, even the largest ironclad, could resist the enormous force of so great a mass of surging water, and if it came within 40 feet of the charge at the time of explosion the iron plating of the vessel would be driven into the sides, and the ship quickly submerged. On land the gun-cotton slabs will play an important part. Cavalry skirmishers, well-mounted, and armed with these blocks, may commit great devastation in a few hours; by their aid railway lines may be blown up, telegraphic communication cut, trees felled across forest roads, light bridges demolished, blockades razed, and infinite damage done in multifarious ways. In future guns will be disabled by exploding in the mouth a charge of compressed cotton—the armourer's hammer and the spike being obsolete tools. Compressed gun-cotton is second only to electricity and light in the quickness of its travel, Mr. Abel having calculated its velocity at from 17,000 to 19,000 feet per second, or 200 miles per minute.

For peaceful purposes other nitro-compounds are more in favour than gun-cotton, and some continental powers make use of several compounds; but the cotton-block has been decided as almost the sole companion of gunpowder by the British authorities. *Nitro-glycerine*, as its name implies, is a mixture of nitric acid with glycerine. This violent liquid explosive is simply prepared by thoroughly impregnating glycerine

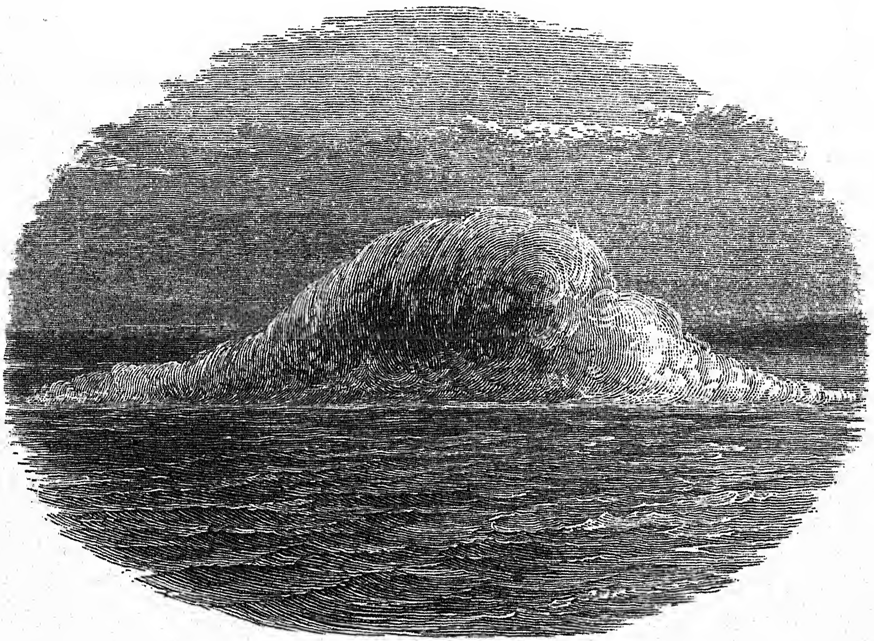


Fig. 211 —Submarine Explosion of 450 lbs. of Gun-Cotton.

with nitric acid, and allowing the compound to fall into a narrow stream of water, when the nitro-glycerine at once separates, the same chemical change taking place as in the case of gun-cotton, the hydrogen or its three equivalents being removed and replaced by the equivalents of nitric pyroxide. The object to be obtained in the manufacture of nitro-compounds is to secure the proper portion of oxygen required to develop the maximum chemical energy, by entirely consuming the carbon and hydrogen present. The full explosive force of unconfined nitro-glycerine

may be obtained by causing even a minute quantity of the compound to explode in contact with the charge; that is to say, that if only the smallest quantity can be *exploded*, the rest will go off as a matter of course. A small primer of fulminate of mercury, detonated in a charge of nitro-glycerine, will cause the whole mass to explode with the most violent force, whether confined or not. The liquid form of nitro-glycerine rendered it most inconvenient for general use or blasting purposes. By mixing a spongy clay called flint-froth, or *kieselguhr*, with the glycerine, a soft plastic material is obtained, very destructive in its action and easy to manipulate, though of course its effect is not so great or complete as the pure nitro-glycerine; and it may be exploded most effectually in the same way as the pure explosive of which it is chiefly composed. This plastic material, called *dynamite*, was at once accepted by miners and quarrymen as the most useful form of the new explosives for their purposes. Steps were then taken to substitute, instead of the inert clay, a body that would contribute in some measure to the explosion. The mixture of sulphur and saltpetre to the clay and nitro-glycerine produced a party material called *litho-fracteur*, much in favour in the Australian colonies.

Glonoine is concentrated nitro-glycerine, whilst *Mataziette* and *Saxafragine* are merely aliases for dynamite of different consistencies and strength. *Dualine* is small granules of gun-cotton soaked in nitro-glycerine, and possesses most ungovernable strength. *Blasting gelatine* is not gelatine at all, but a jelly composed of dissolved gun-cotton and nitro-glycerine. A new compound, *Glyoxiline*, is formed by adding to this gelatine a further quantity of cotton powder, so that it resembles dough, and appears to combine the destructive properties of both gun-cotton and nitro-glycerine.

The manufacture of these nitro-compounds has been for some time an established fact; in Great Britain there are large manufactories at Faversham, Ardeer, and the Government factory at Waltham Abbey. For firearms all nitro-compounds, with the exception of Schultze powder, are altogether unsuitable. Gun-cotton, in a mild form and small charges, has been made use of occasionally in shot guns, but without any beneficial results accruing therefrom. Indeed, the suddenness of the explosion is too great to allow of the proper ejection of projectiles, which require a more elastic and continuous pressure.

MANUFACTURE OF NITRO-COMPOUNDS.

Schultze gunpowder is manufactured from light fibrous woods, similar to those used for making black gunpowder charcoal. The wood is pulped and then changed to nitro-lignum by treatment with nitric and sulphuric acids. The compound is then submitted to purifying and cleansing processes of an exhaustive nature, which entirely remove or destroy all acids or deleterious chemical properties. The powder is then submitted to hydraulic pressure, the cakes broken up, and the powder granulated by churning when in a moist state in revolving drums. The powder has to be dried by steam, exposed to the air, and stored for some time in open cylinders.

Owing to the powder *inflaming only* when in an unconfined state, the Government impose no stringent regulations upon the manufacturers, except with regard to the purification, which must be complete, the presence of acid rendering the powder exceedingly dangerous and unstable.

By Act of Parliament, premises licensed to hold 50 lbs. of black gunpowder may only contain 15 lbs. of Schultze powder, or 15 lbs. of black and Schultze powder mixed. This and the difficulties attending its transit are great drawbacks to the storage of the powder, and make it appear far more dangerous than it is in reality. It is safe to handle or store, and does not inflame until subjected to upwards of 340° Fahr.

"E. C." POWDERS.

The two nitro-compounds, "E. C." sporting and "E. C." rifle grain are officially specified to consist of "gun-cotton" coloured after granulation by aurine dissolved in ether, alcohol, and benzoline for the "Sporting," and the rifle grain gun-cotton coloured by piric acid in a like solution. As made by the Explosives Company at Stowmarket and Pembrey; the processes are as follows :—Cotton-waste is taken as the basis, this is prepared free from acid and moisture by carding, washing, and drying. The nitric and sulphuric acids are mixed by running two contiguous streams into a vat, and further by stirring; when thoroughly amalgamated the cotton is dipped

into them, and converted thereby into *nitro-cellulose.* Apart from the strength of the acids themselves, it is this dipping that determines the strength and explosiveness of the compound; *tri-nitro-cellulose,* as its name implies, is cotton dipped and redipped until not only is the cellulose thoroughly impregnated with the acids, but converted into a new substance far too dangerous to use in arms of any description. The cotton does, however, undergo a complete chemical change, caused by absorption of the acids when dipped but once. The acid-dipped cotton is stored in stone jars placed in running water for some twenty hours. The affinity of the acids for carbon being so great as to engender great heat, enough to cause spontaneous combustion were the jars not kept in constantly changing cold water.

The next process is to free the cotton from surplus acid by washings, and boiling in pure water. By running the boiled mixture into a deep well-like reservoir, the cotton rises, and is scraped down an overflow, whilst grit and impurities sink, and are drawn off with the acidulated water.

The only remaining processes are to pulp the cotton, granulate it by revolving it in drums when moist, the explosive in that form being very near akin to *tonite,* and colour and harden it by drying and steeping it in solutions already specified.

The difference existing between gun-cotton—as now made—*tonite* and the "E. C." powders is small. Compressed gun-cotton is acknowledged to be the safest and most usable of modern explosives either for war or mining purposes; *tonite* is but pulverised compressed gun-cotton; "E. C." the same granulated, and the grains hardened, toned, and made waterproof by absorbing a spirituous chemical mixture. The effect of the "solvent" upon the grains of the "E. C." powder is to reduce the sensitiveness of the powder, render it less liable to atmospheric changes, and make a safe and efficient powder for use in small arms.

HAMMERLESS GUNS.

FIG. 214 represents a double hammerless gun, invented by a German gunmaker. The lock-work is on the same principle as that employed in the Prussian needle-gun, and is contained in the breech. When the gun is cocked, the rear ends of the needles project from the breech, and act as indicators. There is a safety between the two needles, which by pressing down with the thumb, springs backward and takes the power of the main-springs until it is returned to its place, which requires a hard push to effect.

The breech-action is worked by a lever, after the Lefaucheux model, and lying along the fore-end of stock when home. This moves to the left, and by means of an eccentric affixed to its centre pivot, causes the barrels first to move forward about half an inch, and then turns them on a pivot with the breech-ends of the barrels clear of the false breech, as shown in the illustration. This gun takes a central-fire cartridge, which is extracted by two small springs fixed upon the breech-blocks that slip over the rim of the cartridges when the barrels are brought home, after loading. Upon the gun being opened and the barrels moved forward, the cartridge is retained by the small springs until the barrels receive the lateral motion, when they slip from the pressure of the springs, and may easily be removed by the fingers when the barrels are clear of the breech.

DAW'S CENTRAL-FIRE HAMMERLESS GUN.

This gun is illustrated by Fig. 215. It will be seen that the breech-action is very similar to that of his central-fire gun, already described. The lock-work is fixed on the trigger-plate, same as represented in Fig. 216. The cocking, however, is effected by the same lever that works the action-bolt; the needles of this gun also project behind the breech, and serve as indicators. The great fault of this gun is the difficulty in manipulating it on account of the enormous travel required by the lever. The safety is simply a sliding bar working laterally in the false breech; by pulling outward from the breech-action, it blocks the orifices through which the needles have to pass before reaching the caps. The lever is caused to

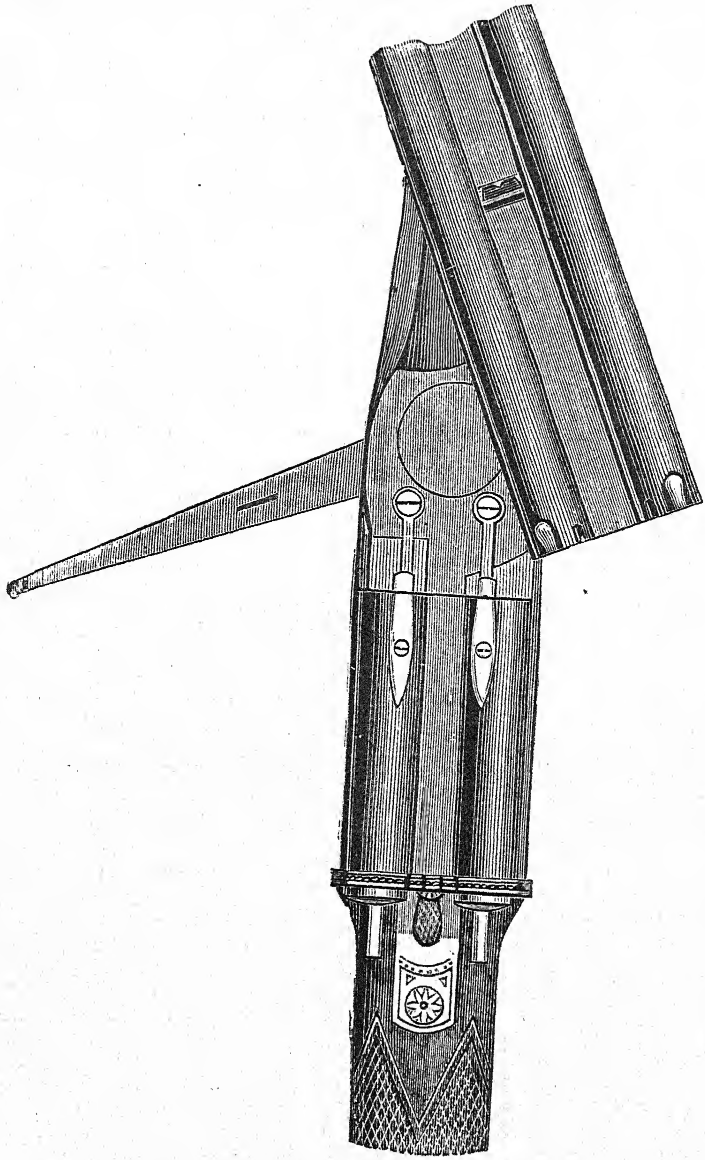


Fig. 214.—German Hammerless Gun.

Fig. 215.—Daw's Hammerless Gun.

snap home by a flat spring lying under the trigger-plate; it is called a Purdey spring, and is now used in all under-lever snap-action guns.

This gun, we believe, was introduced by Mr. Daw about 1862, but it never attained the popularity of his first central-fire gun.

GREEN'S HAMMERLESS GUN.

An illustration of this gun is shown in Fig. 216. The patent was taken out in 1866; it was, therefore, one of the first English central-fire hammerless guns, and is the foundation of several systems now in use.

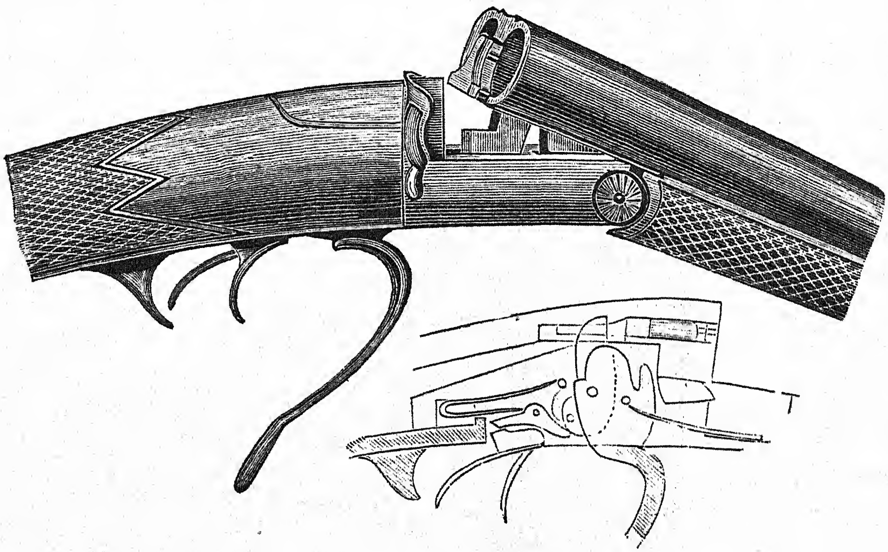


Fig. 216.—Green's Hammerless Gun.

As seen by the illustration, the lock mechanism is attached to the trigger-plate in much the same manner as in the German guns already described. The chief difference consists of the centre-pivot of the lever being identical with the axis of the tumblers, and of the lever being so shaped and adjusted as to form the bow or trigger-guard. There is a safety-bolt to this gun, which is placed immediately behind the false breech. It bolts the strikers, and is worked by turning half round a small thumb-lever on the side of the gun.

THE MURCOTT PATENT HAMMERLESS GUN.

This gun was patented by Mr. T. Murcott in 1871; it is the first hammerless gun in which was employed the ordinary bar side-lock; it differs only from the ordinary lock in having an elongated arm to the

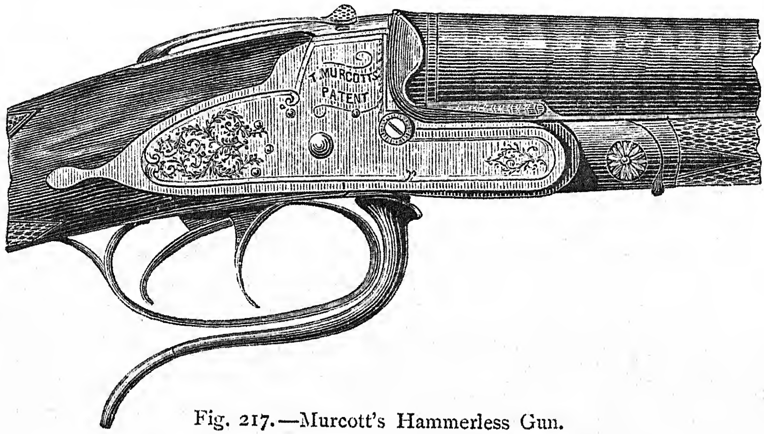


Fig. 217.—Murcott's Hammerless Gun.

Fig. 218.—Mechanism of Murcott's Hammerless Gun.

tumbler to which is affixed the strikers. Fig. 217 shows this gun closed ready for firing. The whole of the simple mechanism is shown in Fig. 218, which represents the gun with the right lock removed and the stock part broken away, exposing section of the left lock. The lever A has drawn back the bolt B, and raised the tumbler C to which is attached the striker D.

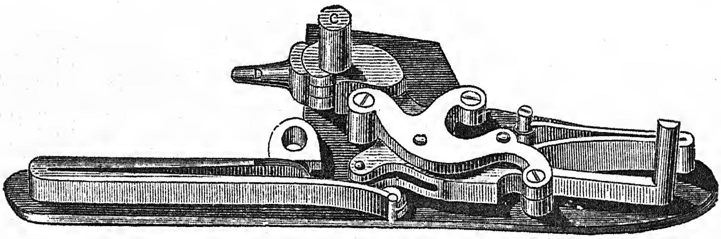


Fig. 219.—Lock of Murcott's Hammerless Gun.

The whole is accomplished by one motion of the lever, A, except the withdrawal of the cartridge-extractor E, which is effected by the dropping of the barrels. Fig. 219 shows the mechanism of the right lock which has been removed from Fig. 218, with the striker D affixed, and the stud on tumbler for the arm of the lever A, to allow when raising it to full cock;

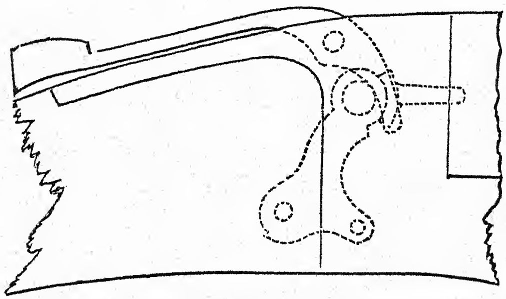


Fig. 220.—Modification of Murcott's Hammerless Gun.

this stud also acts as a preventative to the gun being fired when partially closed. The remainder of the lock is of ordinary construction.

The safety-bolt to this gun is shown in Fig. 217. It is of steel, and all in one piece; by turning the thumb-piece, on top of break-off, to the

left, the triggers are bolted, and the gun prevented from being fired. The loading may be accomplished either before or after making the gun safe. Mr. Murcott's patent also includes a safety to work on the side of the lock-plate, which acts in a similar manner, bolting the triggers. It was through the energy of Mr. Murcott, who always advocated the great advantage of the hammerless system, that many noblemen and gentlemen were induced to give hammerless guns a trial.

This gun is also patented with a top-lever cocking arrangement, as shown in Fig. 220; or the gun may be advantageously made with a side-lever under the same patent. The breech-action lever is snapped home by a Purdey spring, as already described. With the top-lever an ordinary V breech-action spring is used.

THE GIBBS AND PITT HAMMERLESS GUN.—FIRST MODEL.

This gun somewhat resembles the Murcott Hammerless Gun; as will be seen in the accompanying illustration, Fig. 221, the locks are back-action, and are placed under the wood, there being no lock-plates visible.

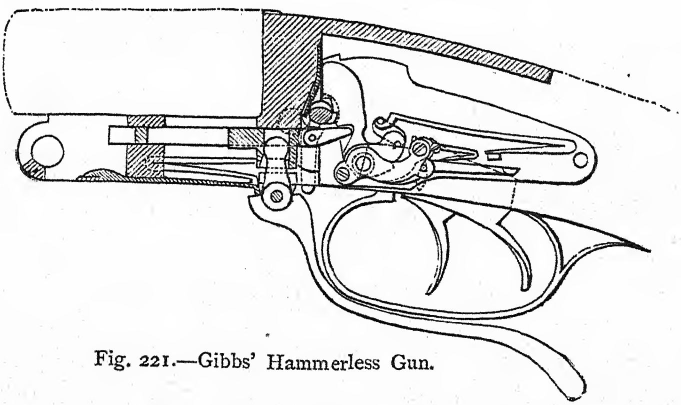


Fig. 221.—Gibbs' Hammerless Gun.

The cocking is effected by a lever similar to and acting in the same manner as the one already described, save that instead of acting directly upon the tumblers it forces back the holding down-bolt, and a cam upon that bolt comes into contact with the tumblers, cocking them when the lever is depressed. This system has long been advocated by a practical German gunmaker and author. The safety is a cross-pin with a thumb-lever on

the right side, and it may be so constructed as to bolt either the triggers or the tumblers.

This gun is occasionally manufactured with a double-grip lever fitting over the guard, which is constructed to work a parallel rod communicating with the tumblers, by which means the cocking is effected.

T. WOODWARD'S HAMMERLESS GUN.

This gun greatly resembles the Murcott gun in appearance, and the cocking is effected by a similar lever fitting over the trigger-guard; the

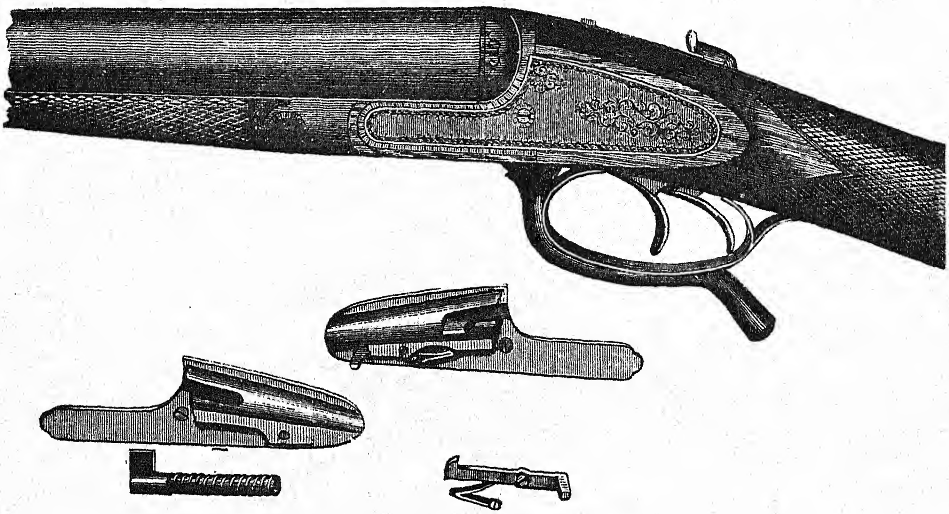


Fig. 222.—Woodward's Hammerless Gun.

principal difference being the construction of the locks, and the form of the safety-bolt. Instead of the ordinary lock, there is a steel pin working on a lock-plate, and having a shoulder, against which the spiral mainspring acts; there is a notch on the pin for the scear to catch into when at cock, and a projection for the arm of lever to press against when forcing the pin into full cock. The safety is fixed upon strap of break-off, and works upon a horizontal pivot in the break-off, the lower extremity reaching to the triggers. When the thumb-piece of safety is

pushed forward, as in the illustration, the lower extremity is moved backwards clear of the triggers; when moved in an opposite direction the triggers are bolted. There are indicators affixed to this gun, which project on the top of break-off when the gun is cocked.

This gun has been in use for some years, but it does not appear to possess any advantages over the hammerless guns constructed with the ordinary tumbler and mainspring, and most gunmakers prefer the old style of lock to this spiral spring arrangement.

SELF-COCKING GUNS.

About this period, 1876 to 1878, an attempt was made by several London and Birmingham gunmakers to supersede the hammerless guns by the introduction of self-cocking guns with hammers. These guns were all similar in principle to the Murcott Hammerless Gun, the cocking being effected by an under-lever acting upon a projection or stud on the tumbler Hammers were affixed to the tumblers in the usual manner. These guns never came into general use, as they possessed only one advantage, viz., rapid loading, which is not always required; advanced sportsmen, and some of the leading gunmakers, having made up their minds that the hammerless would be the gun of the future, the self-cocking hammer gun was never well received, and is but seldom met with. Hammers whether on a self-cocking gun or otherwise, are continually the cause of accidents, from catching in twigs or slipping from the thumb during manipulation.

REEVES' HAMMERLESS GUN.

This gun is worked by an under-lever lying over the trigger-guard, or with a top-lever as shown in the accompanying illustration. The locks are contained in the body of the breech-action; the arrangement is somewhat similar to the Anson and Deeley Patent. The cocking, however, is effected by the lever, which has a projecting arm that comes into contact with the two studs affixed to the tumblers, so that, upon the lever being depressed, the tumblers are forced into the bent. The lock-work is affixed to a bottom plate which fits into a recess cut for it in the breech-action. The chief advantages claimed for this gun are strength and

simplicity of the parts, and the ease with which the locks may be removed and cleaned.

Any of the trigger-bolting safeties described in this work may be applied to this gun. This gun was patented in 1879.

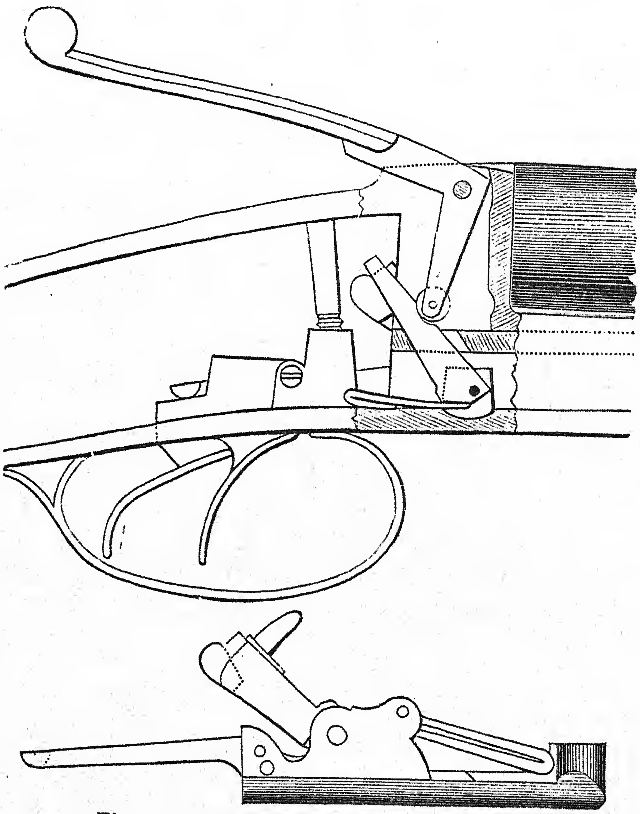


Fig. 223.—Reeves' Hammerless Gun and Lock.

MESSRS. LANG AND SONS' HAMMERLESS GUN.

Messrs. Langs' first hammerless gun resembles both the Murcott and Woodward systems already described. The cocking is effected in the same manner, viz., by a lever having a projecting arm that comes in contact

with the tumblers, as shown in Fig. 218. There is a spiral mainspring, but the scears and tumblers resemble those of an ordinary gun lock. The method of striking and the arrangement of the lock is shown in Fig. 224, which represents the gun with one lock detached and reversed.

There is no safety to this gun, but dummy cocks or hammers are affixed to it, so that the lock may be lowered to half-bent. The gun may be either full or half-cocked with the lever, according to the wish of the shooter.

Messrs. Langs' improved hammerless gun is cocked by means of the barrels. Upon referring to the drawing, Fig. 225, it will be seen that there

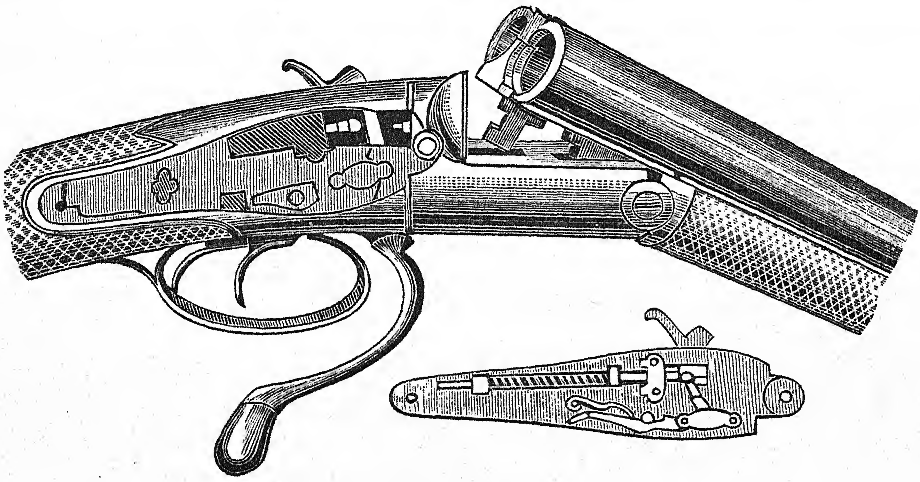


Fig. 224.—Langs' Hammerless Gun.

is a small notch or slot filed in the steel lump under the barrels, into which engages one extremity of the cocking-lever B (this cocking-lever is shaped like a right-angled cross), the other extremity having a hole drilled through it; the pivot upon which the tumblers, A, work is made to pass through the cocking-lever, and so form a centre for both tumblers and lever. There is a projecting stud upon the breast of the tumbler A, under which the arm of the cocking-lever engages when the barrels are dropped for loading. The barrels upon being closed depress the cocking-lever, and thus remove the arms from beneath the studs on the tumblers, leaving them fastened at full cock by the scears, *e*, until pulled off by the triggers. The

safety-bolt is upon the top of the tang of breech-action, and is so constructed as to bolt both triggers and tumblers. The bolt consists of a horizontal rod working underneath tang of breech-action; it has two arms, H H, one projecting through the grip of the stock and bolting the

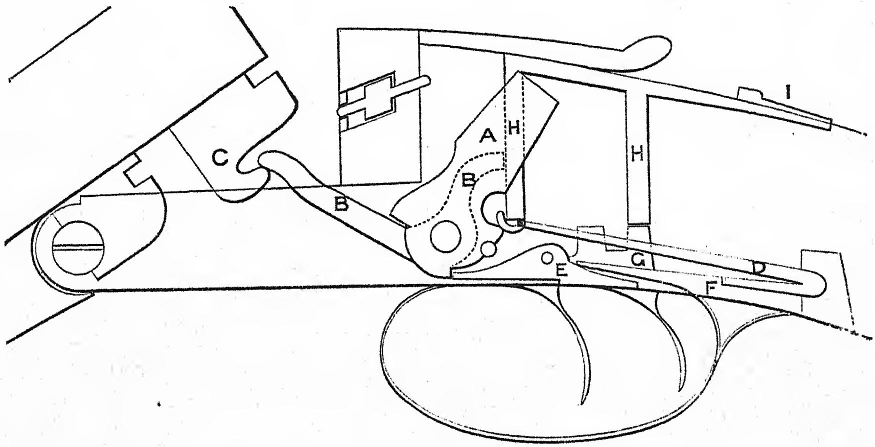


Fig. 225.—Langs' Improved Hammerless Gun.

triggers, the other about 1½ inch further forward and bolting the tumblers; both arms work together, and bolt and are unbolted simultaneously. The bolt is automatic, being pushed backward by a projecting arm of the cocking-lever B, or by the holding-down bolt of the breech-action.

PERKES' HAMMERLESS GUN.

Mr. Perkes has several different hammerless guns, the one patented in May, 1878, greatly resembles Messrs. Langs' Improved Hammerless Gun; it, however, has no cocking-lever, but, as will be seen by the illustration, Fig. 226, the tumblers are themselves extended forwards, and made to engage upon a projection on the lump underneath the barrels. The lock mechanism is arranged upon the trigger-plate. The mainspring is made to do the duty of both tumbler and scear spring, and the tumbler strikes an exploding-pin screwed into the false breech from the face.

There is a safety to this gun, that bolts the triggers, and consists of a

vertical cam swung upon a centre-pivot over the triggers; it is worked by a thumb-piece fixed upon the tang of the breech-action.

There is a small tool required to be used each time this gun is put together, to cock the locks before the barrels can be attached

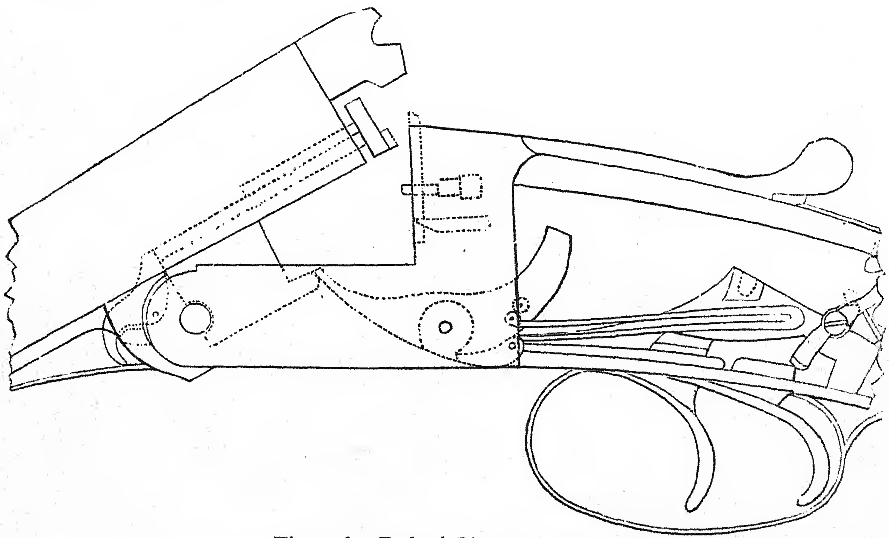


Fig. 226.—Perkes' Hammerless Gun.

WALKER'S HAMMERLESS GUN.—FIRST MODEL.

This gun is cocked by means of an under-lever engaging with an oscillating vertical bolt, the same bolt serving also to secure the barrels to the breech-action. This bolt comes into contact with projecting studs upon the tumblers, forcing them to full cock upon the lever being depressed to open the gun.

THE ADSETT PATENT HAMMERLESS GUN.—FIRST MODEL.

In this gun the locks are affixed to the strap of break-off. The tumblers are reversed, the points striking down, instead of up, to reach the cartridge. It is worked by an under-lever which comes into contact with a projecting stud on the tumblers, and acts upon them in the same manner as in the Murcott, Woodward, and other guns already described.

GREENER'S SIDE-LOCK HAMMERLESS GUN.

This Gun is the "Murcott" remodelled, with the centres of the tumblers brought forward till they coincide with the fulcrum of the lever, and, by altering and re-arranging the lock mechanism, we have been able to produce a gun much neater in appearance, and which will open with a pressure of 10 lbs. upon the lever. It will be seen by the accompanying engravings that the point of the tumbler has been made to explode the

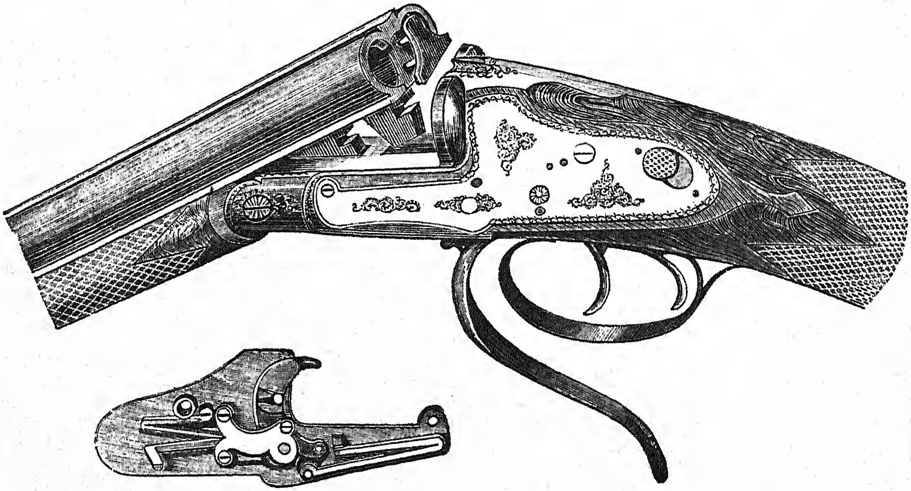


Fig. 227.—Greener's Under-Lever Hammerless Gun and Left-Lock.

caps without any intervening exploding-pins. There is no increase in the number of limbs of the breech-action; the lever being extended above the action-bolt comes into contact with a projection upon each tumbler, and upon the lever being depressed to open the gun, the tumblers are raised into full cock. The scears and tumblers, and scear springs of the lock, are much stronger than those of an ordinary lock, and there are eight less pieces in this gun than in any ordinary gun with hammers. This, however, does not include the safety, which may be either our ordinary side-safety, or an automatic, or an independent safety upon top of action.

GREENER'S "PATENT CLUB" HAMMERLESS GUN.

(*Patented* 25*th April*, 1877.)

This gun is shown in Fig. 227a. It will be seen that it is of the simplest construction, the ordinary side locks being used, with the tumbler formed to fall upon the cap, without any intervening strikers or exploding-pins. The cocking is effected by the under-bolt of the breech-action bearing against the studs upon the tumbler, and forcing them into cock. The

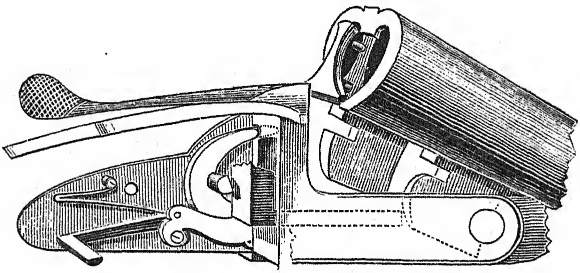


Fig 227a.—Mechanism of "Club" Hammerless Gun.

lever is of the ordinary construction, and placed upon the top of the break-off in the usual manner. When opening the gun, the locks are partly raised to cock by pressing the lever until the action-bolt is free from the slots in the lumps, when the lumps are so formed as to force still farther backward the action-bolt, and thus finish cocking the locks.

CROSS'S HAMMERLESS GUN.

This is one of the cheapest guns on the hammerless system that has yet been constructed, and one requiring great force to cock.

The locking and cocking mechanism is shown in Fig. 228, from which it will be seen that the mainsprings are spiral in form, and lie in the body of the breech-action underneath the barrels ; the remaining lock-work is also affixed to the breech-action body, or upon the trigger-plate. The cocking is effected by an under-lever, which is depressed to open the gun, and acts upon studs upon the tumblers in the same manner as in the

Murcott Hammerless Gun shown in Fig. 218. There is a rod working in the mainsprings, with a head pressing against the tumblers, which are extended below their centres for this purpose. When the breech-action

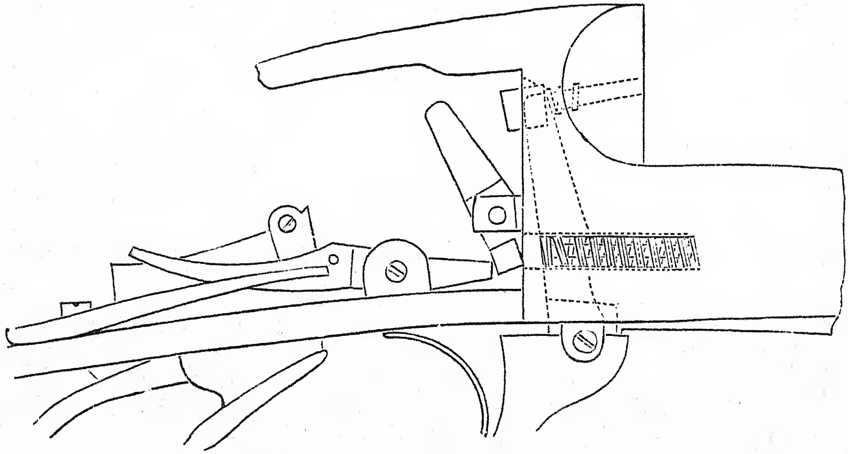


Fig. 228.—Cross's Hammerless Gun.

lever is depressed, and the heads of the tumblers forced backwards into full cock, the rods are pushed forward, and compress the mainsprings. Any trigger-bolting safety is applicable to this gun, which was patented 11th January, 1879.

MILL'S PATENT HAMMERLESS GUN.

In this gun the locks are cocked by a cocking-lever attached to the bottom lump of the barrels by a swivel, and acting in the same manner as described and illustrated in Figs. 225, 226.

BULLOCK'S PATENT HAMMERLESS GUN.

This gun was patented on the 30th May, 1878, and received provisional protection only. The locks are similarly constructed to those patented by Mr. Murcott, but are cocked by the strikers or exploding-pins. An under-lever is used, having an arm extended upwards to a level with the strikers, and by means of a cross connecting-bar is capable of giving to the strikers

a horizontal sliding motion. The tumblers bearing against the heads of the strikers, are forced by them into full cock upon the lever being depressed to open the breech-action.

MATHEWS' PATENT HAMMERLESS GUN.

The hammerless gun of Mr. Mathews is made upon two separate models: in one the locks are cocked by means of a lifting-cam engaging with a slot in the back lump under the barrels, in much the same manner as in Langs' Hammerless Gun, shown in Fig. 225; in the other the locks

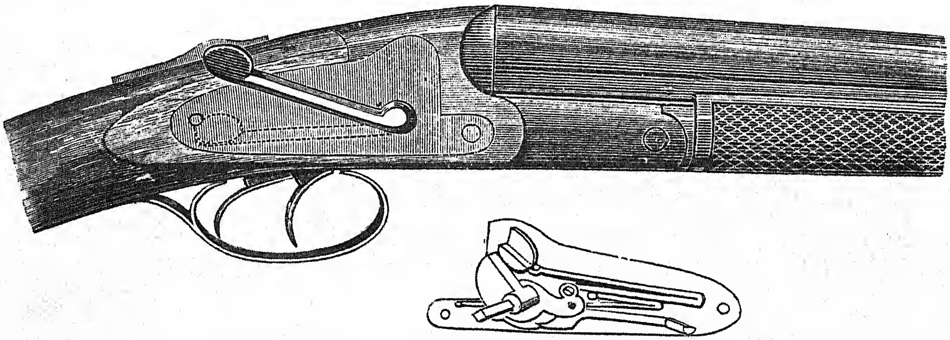


Fig. 229.—Mathews' Hammerless Gun and Lock.

are cocked by the breech-action lever acting as shown in the accompanying illustration, Fig. 229, which we will now describe.

The lock mechanism is arranged upon side-lock plates, and greatly resembles in its arrangement the system used by Mr. Murcott in his Patent Hammerless Gun. The lever which works upon the outside of the lock plates is in one piece with its pivot, which is square in the centre and cylindrical at each end. This central pivot passes through the tumblers, and acts as a centre for them to work upon. To the square centre of this pivot is affixed a cocking-lever, extended upward and engaging with the studs upon the tumblers, so that, when the lever is depressed to withdraw the breech-action bolt, the cocking-lever presses against the studs on the tumblers, and forces them into full cock. This

gun is fitted with a safety-bolt working upon the tang of the break-off, and passing through the grip of the gun to the triggers, as shown in Fig. 222. This gun was patented 5th October, 1878.

SCOTT'S HAMMERLESS GUN.

(*Patented 23rd February*, 1878.)

In this gun the cocking of the locks is effected by the rising of the barrels for loading. The cocking mechanism is shown in the illustration

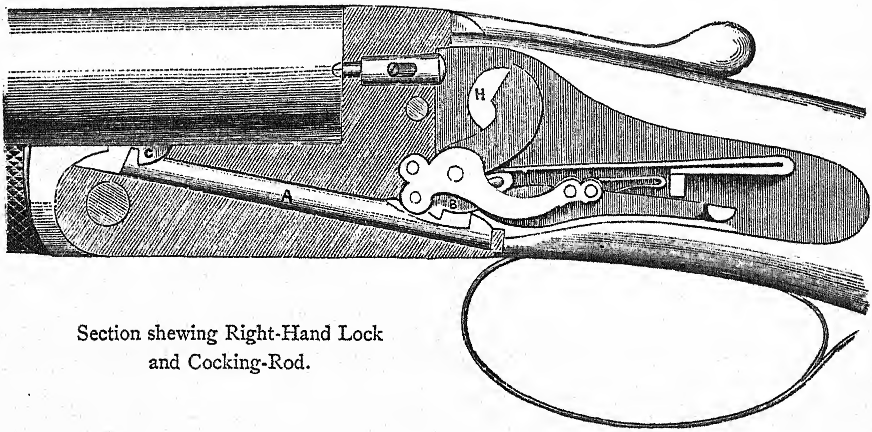


Fig. 230.—Mechanism of Scott's Hammerless Gun.

(Fig. 230), from which it will be seen that there are rods, A, moving diagonally in the body of the breech-action, and which have a notch in their fore extremity with which two studs, C, fixed upon the flats of the barrels are made to engage, their opposite extremities engaging with the tumblers at B. Upon the barrels being raised for loading, their leverage draws forward the horizontal cocking-rods, which communicate a like motion to the extended arms of the tumblers, and so raise them into full cock. The lock mechanism employed is affixed to side-lock plates, and is similar in construction to that generally used in modern hammer-

less guns, and the lock-plates have crystal apertures, H, which expose to view the position of the tumblers, obviating the use of indicators.

More recent patents have been taken to secure more perfect mechanism in this gun, and it may now be manipulated with greater ease, and is much more pleasant to use than formerly, whilst its efficiency has been enhanced. Messrs. Scott have special safeties and checks applicable to this and other guns, which will be fully described later.

GYE'S PATENT HAMMERLESS GUN.—FIRST MODEL.

In this gun the locks are cocked by a double swivel, swung on a pivot on the rear portion of the under lump, and the tumblers have an arm

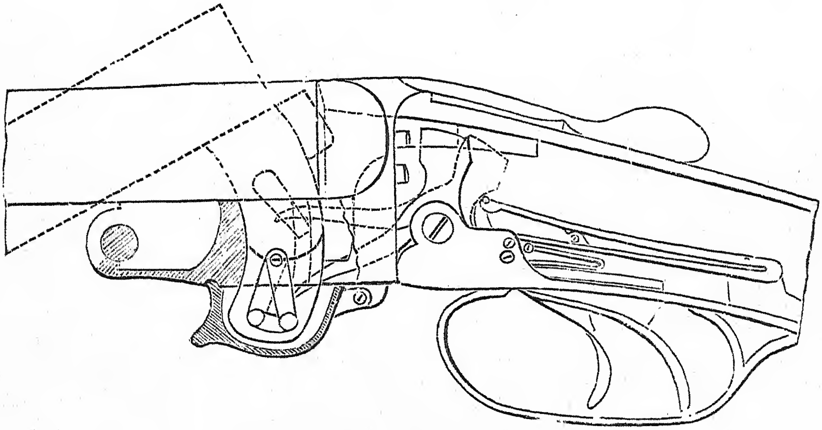


Fig 231.—Gye's Hammerless Gun.

extended forwards engaging with the swivel. To get sufficient travel to cock the locks, the under lump has to be lengthened, and consequently projects nearly half an inch beneath the body of the breech-action. The position of the swivel and tumbler arms prevents the lump from fitting closely against the side of the slots in the breech-action body. To disengage the barrels from the breech-action or stock of the gun, a small hinged cover, protecting that part of the lump which appears through the body of the action, must be opened, and the swivel swung clear of the tumbler arms.

The illustration (Fig. 231) will show at a glance the mechanism of this gun. The lock-work is arranged upon the trigger plate, and constructed upon the rebounding principle, the necessity for which we fail to see, as the hammers must be carried at full cock except when discharged, and the rebound only weakens the blow given to the cap. This gun was patented 8th March, 1878, but we understand is no longer manufactured.

HODGE'S PATENT HAMMERLESS GUN.

This gun is worked upon a similar principle to our Patent Hammerless Gun (1,623, 1877), illustrated in Fig. 233. The cocking is effected in the same manner by the breech-action bolt, which, however, is forced backward by an under-lever, and not by the lump on the barrels. A roller is affixed to that part of the bolt that comes into contact with the tumblers, and lessens the friction whilst forcing them into full cock. The lock mechanism is arranged upon the trigger plate. A safety bolt is fixed to this gun, which bolts the scears to the triggers. It is worked by a small button placed in the tang of the guard, which slides longitudinally along the tang, and is drawn back to unbolt the gun. It may be made self-acting by affixing a pushing bolt with a reversible crank action, to work against the breech-action bolt.

This gun was patented the 22nd March, 1878.

PARSON'S PATENT HAMMERLESS GUN.

This gun is shown in the accompanying sectional illustration, Fig. 232. The cocking is effected by a sliding bolt working in the false breech, one extremity bearing against a stud upon each tumbler, the other pressing against the back of the lump under the barrels. This lump is shaped (see Fig. 232) in such a manner as to give a horizontal sliding motion to the cocking bolt upon the barrels being raised for loading. The action has an extension top-rib fastening similar to that of Messrs. Westley Richards, and is not held down by any bottom bolt. This patent is dated 18th March, 1879, No. 1,065, and has been anticipated by our patent of 25th April, 1877, No. 1,623, a description of which will be found appended to Fig. 227a. The safety to this gun is a rectangular rod situated in the false breech, with each extremity projecting through the lock-plates, and moves

transversely before the tumblers. There are two projecting arms to the safety-rod, and corresponding slots filed in the tumblers, so that the rod shall not interfere with the movement of the tumblers, unless moved to the left by pressing one of its extremities with the thumb or finger, when the projecting arms are moved opposite the tumblers; so that, if the gun is discharged with the safety-rod in this position, the tumblers are arrested before coming into contact with the exploding-pins. The tumbler is then supposed to rebound into half-bent from the force caused by striking the steel safety-rod. The safety may be made automatic by forming a wedge-

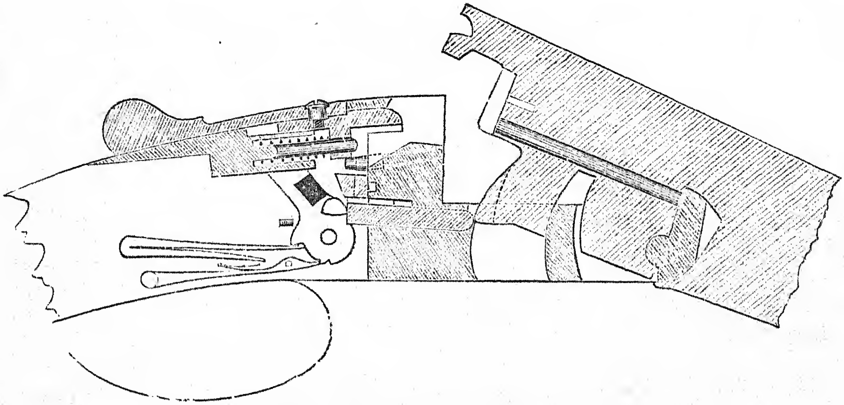


Fig. 232.—Mechanism of Parson's Hammerless Gun.

shaped projection on the cocking-lever that will engage with the safety-rod when the barrels are raised for loading. This gun is the "*invention!*" of a country gentleman, and is no longer manufactured by Messrs. Tolley.

SAMUEL B. ALLPORT'S HAMMERLESS GUN.

The double-grip under-lever is employed in this gun for cocking the locks, and there being a sufficiency of leverage and travel available, a thoroughly successful result is obtained.

For convenience of manufacture, the lock mechanism, consisting of tumbler, scear, and mainspring, are fixed to the trigger-plate. The

tumblers and cocking-lever are pivoted on a common centre, an arm from the cocking-lever projects under each tumbler forward of their centre. The other end of this lever is furnished with a friction-roller, and travels up a heliacal curve on the vertical cylindrical head of the breech-action lever.

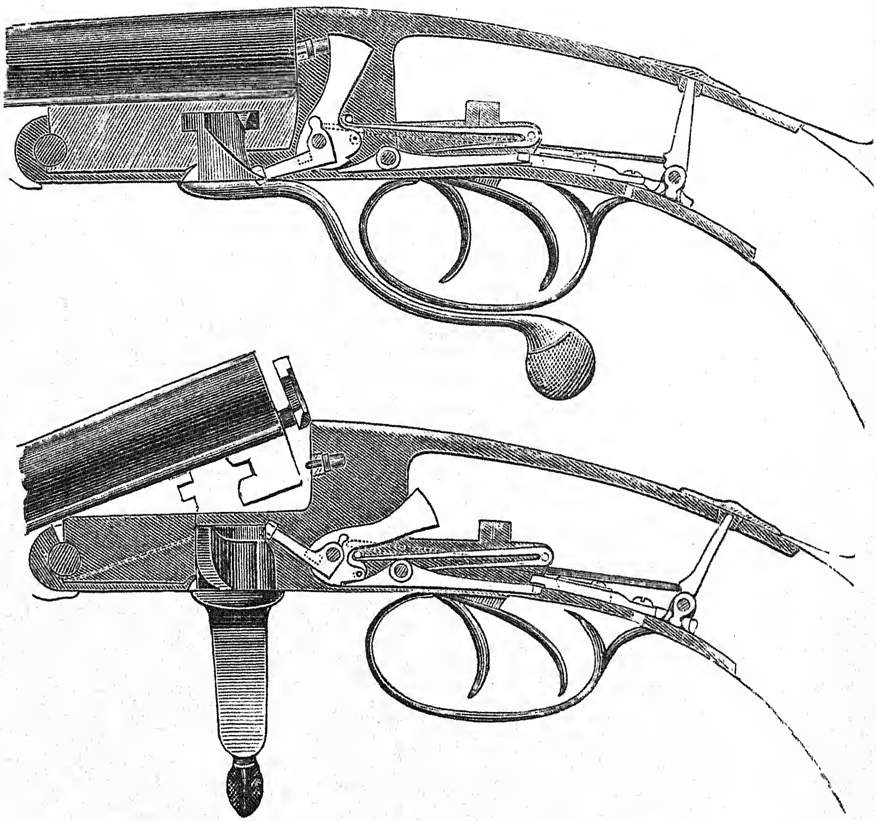


Fig. 233.—Allport's Double-Grip Hammerless Gun.

The action of the parts is as follows :—On opening the gun, the under lever is made to describe the quadrant of a circle, the cocking cam, by travelling up the curved plane of the action lever, becomes a powerful

lever of the second order, and without any appreciable strain raises both locks into full bent. On closing the gun the cocking-lever descends, and the gun may be fired. The preference given by many to the double grip lever, and this ready method of utilising it in a hammerless gun will make it popular for double and single rifles and guns; and as the whole of the mechanism is exceedingly simple and strong, the gun, although as yet but little known, will doubtless prove durable, and merit success.

A most ingenious, simple, and effective method of bolting the scears and triggers of this gun is protected by the same patent, and will be again referred to.

RIGBY'S PATENT HAMMERLESS GUN.

(*Patented March* 21*st*, 1879.)

The mechanism of this gun is shown in Fig. 234. The solid metal left in the body of the breech-action is shown shaded, whilst the barrels, lump, cocking-levers and bolt are plainly outlined.

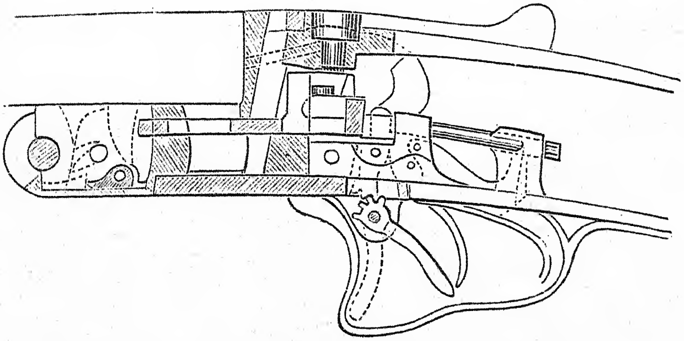


Fig. 234.—Rigby's Hammerless Gun.—First Model.

The breech-action is secured to the barrels by three bolts, an ordinary double-bottom holding-down bolt, travelling horizontally in the body of the breech-action, and a vertical or nearly vertical bolt engaging into an extended top-rib, in much the same manner as that of the old Abbey breech-loader and the new hammerless gun invented by the editor of the

Field. The gun is worked with an ordinary top-lever, or more preferably by an under-lever over guard.

The cocking is effected by a double horizontal sliding-rod working each side of the bottom holding-down bolt. The motion is given to the rod by a combination of levers and cranks affixed to the fore lump under the barrels, and the rear end acts upon studs upon the tumblers in the same manner as the Parson Hammerless Gun already described, or the holding-down bolt itself is made to act directly upon the tumblers, when actuated by the lever only or assisted by the barrels. The mode of actuating the safety-bolt—by an under-lever and ratchet as patented—is now discarded, and a thoroughly efficient top-safety bolt employed. The gun has of late been greatly improved by simplification of the mechanism, and is superior to the average of under-lever hammerless guns.

HILL'S PATENT HAMMERLESS GUN.

This gun greatly differs from the hammerless systems already described, as it is the closing of the barrels that cocks the locks, not the raising of the breech-ends for loading, as is usually the case in modern hammerless guns.

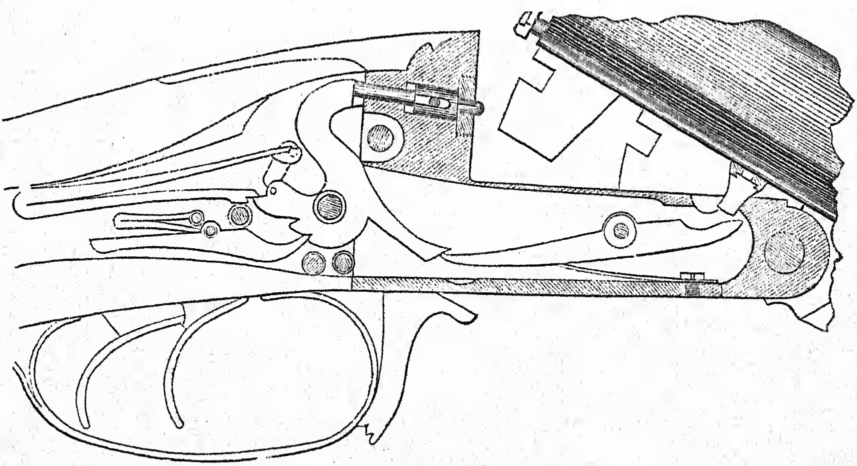


Fig. 235.—Hill's Hammerless Gun.

It will be seen by the illustration (Fig. 235) that the lock-work is affixed to a side-plate in the usual manner, but the cocking-lever is fixed in the body of the breech-action. This cocking-lever is hung upon a pivot; one extremity engages with an extended arm of the tumbler, and the other is acted upon by a studded rod working transversely through the fore lump under the barrels. The two studs upon this rod, on the barrels being closed, come into contact with and press downward the fore extremity of the cocking-levers, and so raise the tumblers into full cock, and hold them in this position until moved transversely to the left by a finger of the left hand. It thus acts as a safety-bolt, which can easily be moved when the gun is raised to the shoulder for firing. This gun, which we believe is novel in its principle, was patented May, 1879, but its manufacture has not been continued.

THE LEFEVER HAMMERLESS GUN.

This gun is the production of a well-known maker of the United States, and is shown in Fig. 236. It mainly differs from English hammerless guns in having a separate lever to cock the locks. The

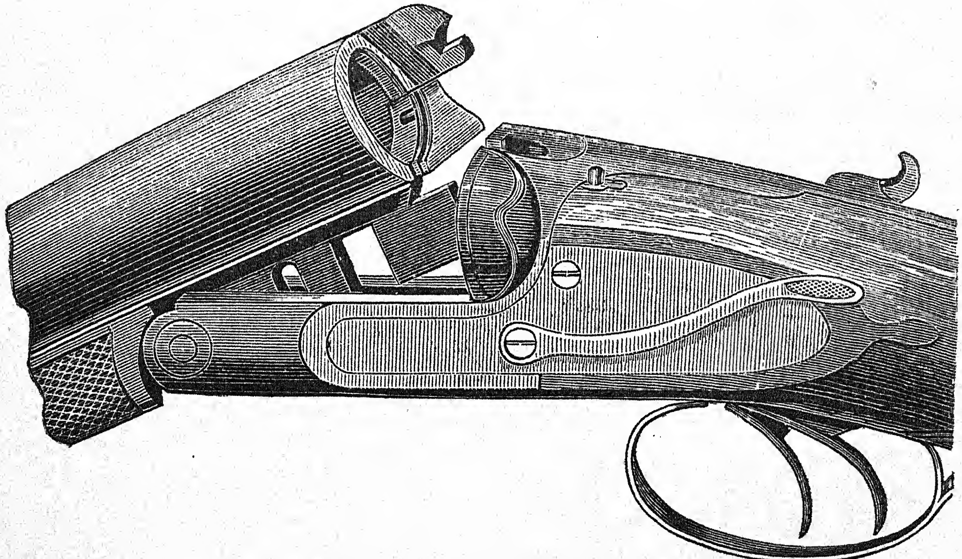


Fig. 236.—American Hammerless Gun.

barrels are fastened to the breech-action by a "doll's-head" extension of the top-rib, into which a bolt, sliding under the tang of the breech-action, engages. This bolt is actuated by a diminutive lever upon the grip of the stock, and which is pushed forward by the thumb to withdraw the bolt.

The locks are cocked by means of a separate side-lever acting upon studs on the tumblers in the same manner as in the "Mathews" Hammerless Gun, the mechanism of which is shown in Fig. 229. The intention of hammerless guns is to simplify the mechanism and lessen the movements for loading; but in this gun two separate motions are required—a push forward to open the gun, and a separate lever must be depressed to cock it.

We consider this gun a hybrid, and possessing in a small degree only the advantage of the hammerless gun proper, by which it will undoubtedly soon be superseded.

BONEHILL'S HAMMERLESS GUN.

(*Patented June 11th*, 1878.)

This gun we represent in Fig. 237. It will be seen that the tumblers pivoted to the lock-plates are raised to full cock by a cocking-lever pivoted in the action-body, and engaging with a swing cam attached to the barrel lump.

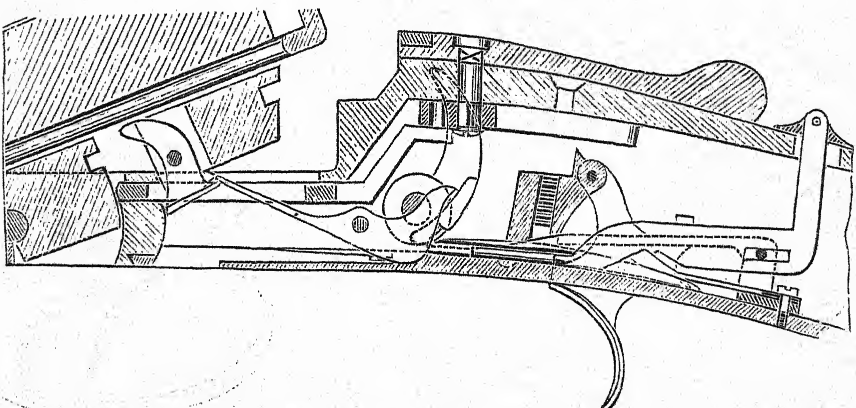


Fig. 237.—Bonehill's Hammerless Gun.

THE "FIELD" HAMMERLESS GUN.

This gun, the invention of the Editor of the *Field* newspaper, was first shown by him at the *Field* Gun Trials of 1866; but the gun had

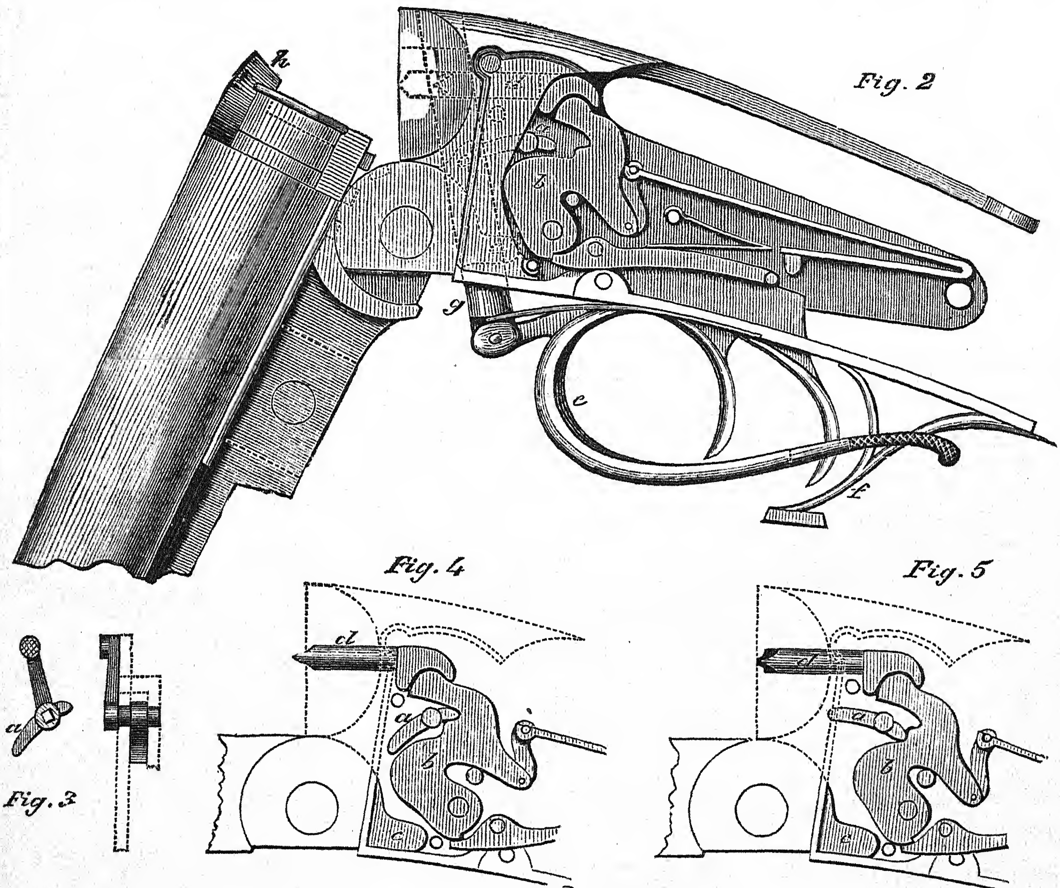


Fig. 238.—The *Field* Hammerless Gun.

hammers. In 1879 he produced the hammerless gun illustrated in Fig. 238.

The locks are raised to full cock by the act of opening the gun for

loading, and in a similar manner to that employed by C. E. Sneider, of Baltimore, U.S.A., in 1865. Sneider cocked his gun by a sliding-rod moving diagonally in the break-off, one end pressing against an eccentric from the breech-action joint-pin, the other against the nose of the hammer. In the *Field* hammerless gun the same form of breech-action is employed, and the same principles evolved.

The mechanism of the *Field* gun will be readily understood by reference to Fig. 238. No. 2 is a sectional view of the gun complete. It will be seen that the breech-action body is very short; in fact, hardly continued beyond the face of break-off itself; consequently the barrels have to drop at nearly right angles to the action before the cartridges can be inserted. The barrels are held in position whilst firing by the vertical bolt, *g*, attached to the action-lever, *c*, which forms part of the trigger-guard. The upper extremity of this bolting lever, *g*, enters the extension of the rib, *h*.

From the fore-end two short arms, *c*, extend and engage with the breasts of the cocks or tumblers, *b*. These arms, on the barrels being dropped for loading, describe part of a circle, and the breasts of the cocks, *b*, being an inclined plane, they force the latter backwards, causing each tumbler to turn on its pivot until the scear slips into the bent and keeps the tumbler at full cock. The strikers, *d*, are separate from the tumblers, and work horizontally in the break-off.

The safety-bolt, *a*, is automatic, and bolts the tumblers. There are two notches filed in the throat of each tumbler, *b*, one notch being considerably deeper than the other. Upon the gun being cocked, the arm from the fore-end, *c*, presses against the extended arm of the safety (*a*, No. 3), moving the opposite arm of the safety to the position indicated in No. 2. Should the trigger then be pulled or the cock fall, the striker will be prevented from reaching the cap by the short arm of the safety entering the shallow notch in the tumbler, as in No. 5; but on the safety-bolt being reversed or moved from "safe" and the trigger pulled, the striker, tumbler and safety fall into the positions indicated in No. 4, and the gun is discharged.

To open the gun, the lever over the guard is pressed upward toward the gun as in No. 2, and not depressed, as is the general rule.

The objections made to the gun are the long drop required by the

barrels and the peculiar shape of the breech-action, which appears to be reverting to first principles, for weapons very similar in construction are shown in Figs. 81 and 82, page 100.

Lefaucheux gained a great part of the success that attended his first breech-loader from the fact of his having moved the joint of the breech-action forward, thereby equalising the strain, which it has been proved cannot be sustained by a single top fastening so well as with the combination of top and bottom fastenings.

A gunmaker who has made this gun in considerable quantities uses a top-lever instead of the lever under-guard; but this alteration of the model cannot be considered the *Field* gun proper, neither has it become at all popular.

NEEDHAM'S HAMMERLESS GUN.

In Needham's Hammerless Gun, Fig. 239, the breech-ends of the barrels are forced up by the lever, and the gun at the same time cocked and the empty cartridge case ejected.

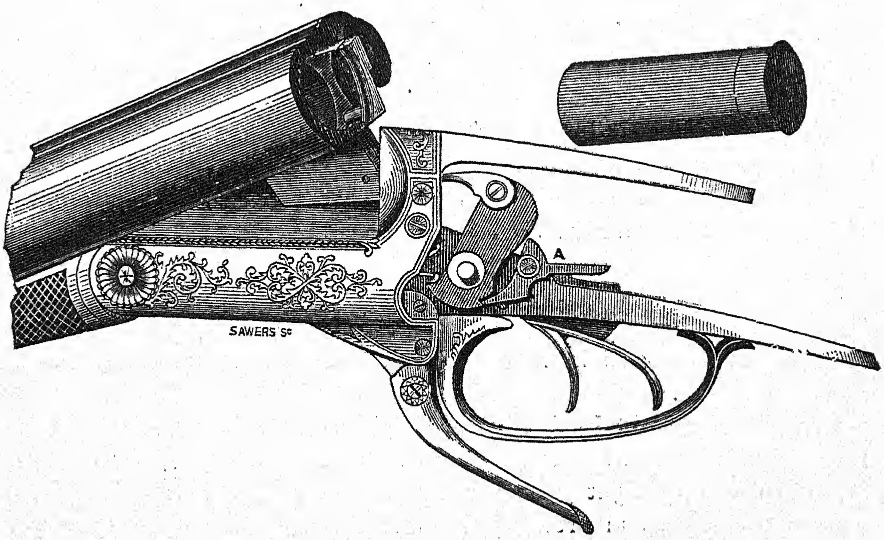


Fig. 239.—Needham's Hammerless Gun.

The lever is pivoted underneath the body of the breech-action, and its upper extremity presses against the bottom of the steel barrel lump when depressed, and at the same time withdraws the holding-down bolt. The lump then engages with the projecting arms of the tumblers, and raises them to full cock.

The special feature of this gun is the extractor, or rather the ejecting arrangement by which the fired cartridge case is thrown clear of the gun.

The extractor itself is in two halves, and extracts to the usual distance in the ordinary manner. The arm of the tumbler then slips over a projection on the steel barrel lump, and falls with considerable force on to a lever or "ejector" pivoted in the barrel lump and engaging with the extractor. The force of the blow given to the "ejector" suddenly propels the extractor an additional quarter of an inch, and jerks the empty case out of the chamber.

The extractor and "ejector" being in duplicate, one for each lock or barrel, and the act of raising the tumbler to full cock ejecting the case, the cartridge in the barrel that has been fired is alone ejected; but if both barrels are fired, of course both cartridge cases are ejected, the ejecting force lies in the mainspring of the lock, and is in no way dependent upon the lever, nor does it require a special effort from the shooter.

Another feature in this gun is the peculiar shape of the tumbler and scear, which are so arranged that the former forces the latter into bent, making the gun safe to use without a scear spring. This arrangement will be better understood by reference to A, Fig. 239.

THE ANSON AND DEELEY HAMMERLESS GUN.

This gun, patented in 1875, may be termed the first really successful hammerless gun.

The leverage obtained by the weight of the barrels, forward of the hinge-pin, is almost sufficient, *per se*, to raise both locks to full bent, and even in very light guns but little force is required, whilst the lever works as easily as in ordinary top-lever guns, it being in no way connected with the lock-work.

The success of this gun may also be in part due to the fact that it is more conveniently made with top-lever action, whereas previous hammerless guns were constructed with bottom and side-levers only.

The lock-work of the gun we have already described and illustrated in Fig. 197, and we have only to state that it is simple in construction, durable, safe and in every way efficient, and applicable to most single and double guns and rifles.

The annexed illustration (Fig. 240) will show the arrangement of the limbs and the means by which the gun is cocked. The tumbler, or striker, has an arm projecting forward beneath the body of the breech-

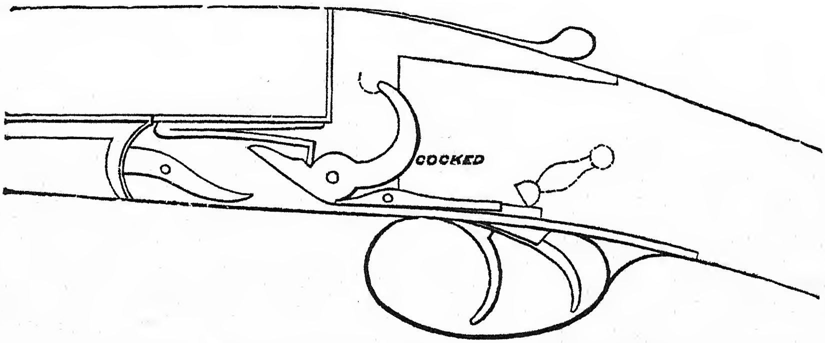


Fig. 240.—Mechanism of the Anson and Deeley Hammerless Gun.

action, and under its foremost extremity is one arm of the cocking-lever or "dog." This dog is pivoted concentric with the hinge-pin, and has its opposite extremity projecting through the joint of the breech-action body, and entering a slot in the fore-end; upon the barrels being dropped for loading, the fore-end is depressed and carries with it the fore-arm of the cocking-dog; the after-arm is consequently raised, and the tumbler, by projecting over the extremity of this arm, is raised by it until it reaches full bent, and is retained there by the scear.

The great safety of the lock-work is owing to the breadth of the scear and tumbler, which is double that of an ordinary gun-lock, and the depth of the bent itself, which necessitates a better hold by the scear.

The lock mechanism has stood tests sufficiently severe, but it is no longer the easiest to manipulate, and its chief drawback is the square and

clumsy appearance given to the gun, especially just underneath the breech-ends of the barrels, as will be seen by referring to Fig. 241, which represents the Westley Richards' hammerless gun with the Anson and Deeley lock-work, and the Anson patent Automatic Trigger-Bolting Safety, which is also shown detached.

The method of making the barrels fast to the stock is the well-known Westley Richards' doll's-head top-lump and top-lever. We have already spoken of the merit of this action, and illustrated it in Fig. 177. The

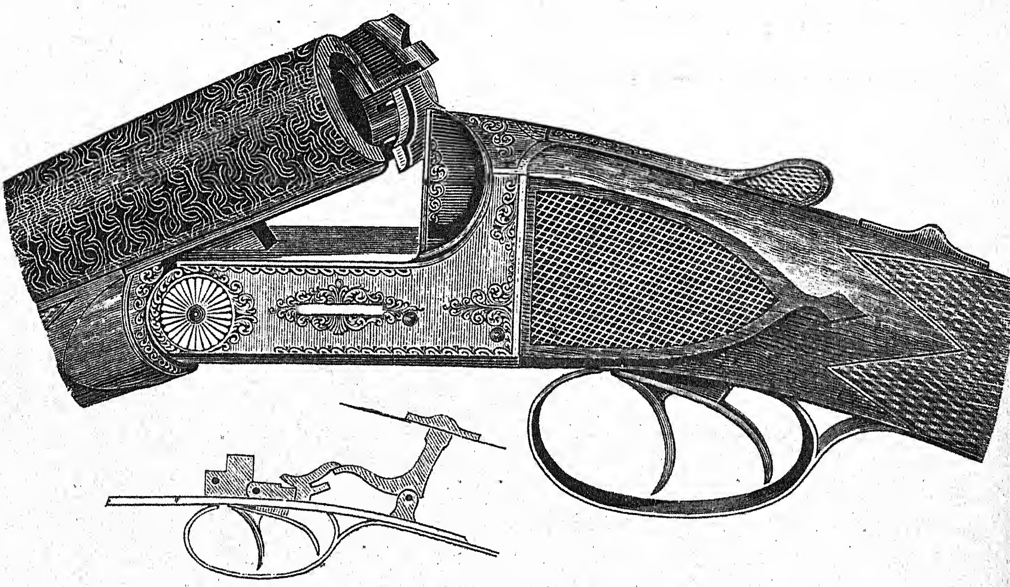


Fig. 241.—The Westley Richards Hammerless Gun.

Safety has the disadvantage of cutting away the wood in the narrowest and consequently the weakest part of the stock. It is automatic in action, the spindle of the top-lever action-spring forcing the arm backward, upon the lever being moved to open the gun.

The gun as made by Messrs. Westley Richards is undoubtedly serviceable, but the Anson and Deeley gun, as made by many of the Birmingham trade, is not so. In order to cheapen the cost of production and cut down the prices, guns are made with loose hinge-pins, sham top-fastenings, and

even in some cases without any top-connection whatever. As may be expected, these guns will not stand continual wear; and several have already come under our notice that, after firing a few shots, were found to be wide between the breech-end of the barrels and the face of the breech-action; although, of course, the guns had passed the Government proof-tests.

GREENER'S TREBLE-WEDGE-FAST HAMMERLESS GUN, THE "FACILE PRINCEPS."

This new gun we illustrate in Fig. 242. It will be noticed that the shape of the breech-action is neater than the Anson and Deeley hammer-

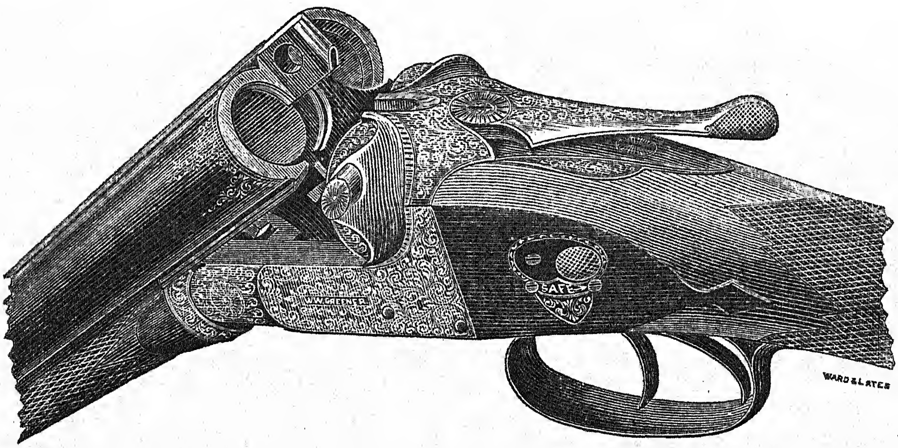


Fig. 242.—The Treble-Wedge-Fast Hammerless Gun, with Greener's New Patent Locks.

less gun, shown in Fig. 240. This is due to an entire change in the lock-mechanism and method of cocking the gun, and by it a strong screw joint-pin is substituted for the solid hinge-pin; the holes through the breech-action joint and fore-end are not required, and the lifting-cams, or "dogs," are dispensed with. This allows of a round-shouldered body being substituted for the objectionable square Anson and Deeley pattern body, and greatly increases the handiness and solidity, besides adding to the appearance of the gun.

In this new gun the cocking is effected by a swivel, or hook, suspended from the barrels immediately behind the first lump. The tumblers are similar in shape to No. 3 in Fig. 197, but have the fore extremities turned inwards, meeting in the centre of the breech-action body; the hook of the

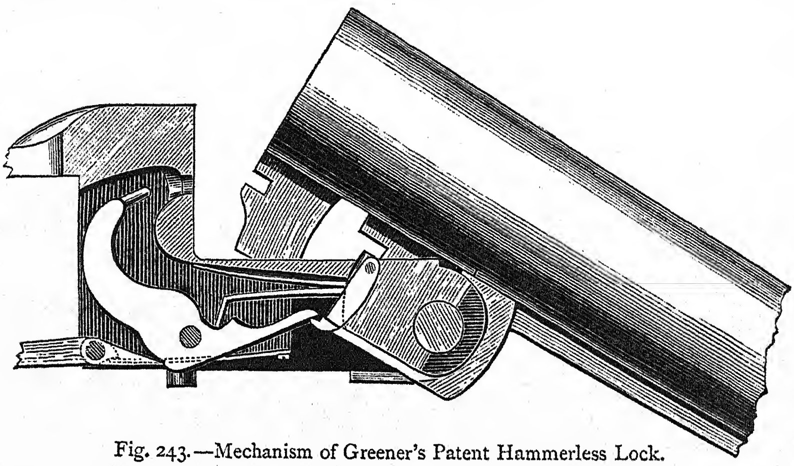


Fig. 243.—Mechanism of Greener's Patent Hammerless Lock.

suspended swivel catches beneath these curved extremities of the tumblers, and upon the barrels being dropped for loading, raises them with the breech-ends of the barrels, and thus effects the cocking.

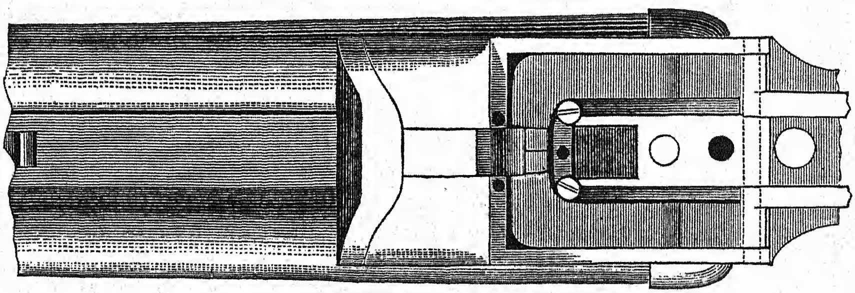


Fig. 244.—Arrangement of Greener's Patent Hammerless Lock.

The shape and purpose of the swivel will be readily understood by referring to Fig. 243, which shows the mechanism of the lock, the gun being open for loading.

In dismounting the gun the fore-end is first taken off, the swivel then falls clear of the tumblers, and passing them, enables the barrels to be removed without difficulty; to keep the swivel to its work and underneath the tumbler, a sliding-rod in the under barrel-lump acts as a stop when the fore-end iron is placed upon the gun.

Fig. 244 shows this more clearly, also the manner in which the tumblers are turned in beneath the breech-action.

The locks of many hammerless guns do not admit of being readily taken apart and re-assembled, especially with tools and means at the

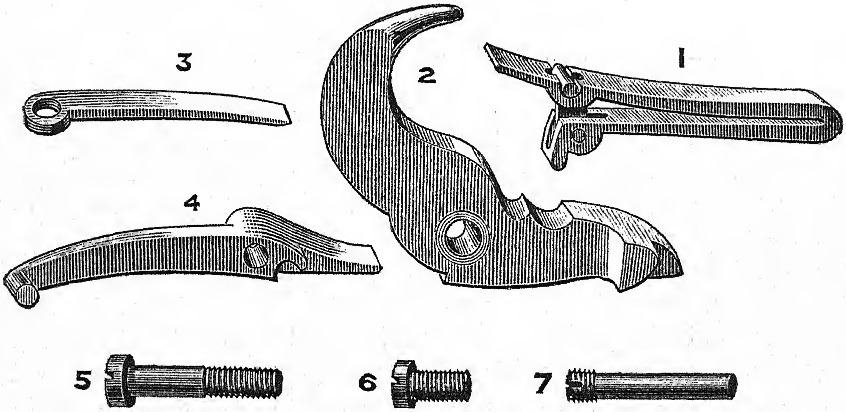


Fig. 245.—Limbs and Pins of the "Facile Princeps" Lock.

command of a sportsman. The "Facile Princeps" is not one of these, for a cramped mainspring is used, and all the parts are to be removed and replaced with the assistance of a turnscrew. The whole of the lock-work is illustrated in Fig. 245 (seven pieces in all). The scear and tumbler-bent are double the depth, and nearly double the width, of an ordinary lock-bent. The mainspring, 1, is always cramped as shown, the requisite travel and momentum being acquired by still further compression; 2 is the tumbler, with extended forearm for cocking; 3, the scear-spring; 4, the scear; 5, the tumbler-screw pivot; 7, the scear-screw pivot; 6, the scear-spring pin, all actual size.

N*

The chief advantages possessed by this gun over the Anson and Deeley, besides those already mentioned, are—By substituting a swivel for a lifting-cam more leverage is obtained, thus the gun is more easily cocked, the weight of the barrels being sufficient to raise the tumblers, although the mainsprings are as strong as in the Anson and Deeley.

There is less friction, the "lifting-dogs" being dispensed with; and the gun is more readily taken apart and put together, it being immaterial whether the gun is cocked or not upon replacing the barrels, and he body of the breech-action may be made longer and consequently stronger—a great advantage for large-bore guns and all rifles.

GREENER'S PATENT SELF-ACTING HAMMERLESS GUN.

The highest development of the modern sporting gun is one that possesses a breech-action that is self-fastening, a lock that is self-cocking an extractor that is self-ejecting. Such a gun surely may be termed self-acting. Such a gun, if possessed of a simple mechanism, of the qualities of durability, handiness and safety, is clearly a desideratum. If the gun here illustrated possesses all these qualifications time will show. Although fully believing in the worth and superiority of this much-commended system, or systems—for the "Self-acting Gun" embodies many improvements, and almost every limb is protected by a separate patent—we shall but describe it, leaving it to others to mete out the praise or condemnation.

The breech-action is the treble-wedge-fast already described; the lock mechanism, the "Facile Princeps;" the cocking mechanism, too, is the same, save that the ejecting gun has the addition of a stud, which is left on the hooked cocking swivel about midway; immediately beneath this stud project the lower extremities of two ejecting levers, pivoted in the barrel lump, and communicating with the legs of the extractor. The extractor is slit into two halves, each half acting independently of the other, and in connection only with its own barrel and lock.

Presuming that the gun has been fired, the action is as follows: On opening the barrels, the tumblers are raised by their turned-in forward extremities bearing on the additional stud of the cocking swivel; when nearly to cock, they slip past the stud and fall sharply upon the ejectors'

Fig. 246.—Greener's Self-acting Hammerless Gun.

lower arms, and the extractors, already forced partly out by lever in fore-end in usual manner, are violently propelled to their full extent by the blow, and flip out the fired cases. If one cartridge only is fired, the other lock, remaining at cock, does not engage with cocking swivel or ejector lever ; consequently, unfired cartridges are simply withdrawn to the ordinary extent.

The power available for ejecting the cases is only that of the main-spring falling about one-eighth of an inch, with an initial force of 18 lb., slightly increased by leverage gained in pivoting the ejecting cam. This force alone would not extract a case ; but, owing to the case being partly

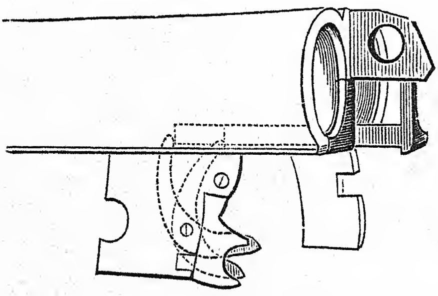


Fig. 247.—Section of Greener's Ejector-Barrels.

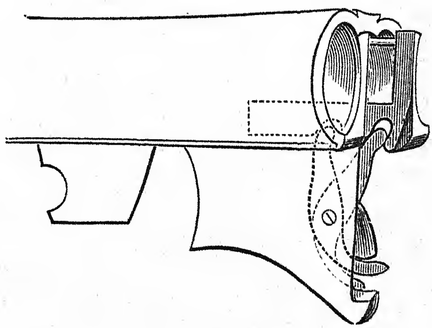


Fig. 248.—Section of Barrels of Hybrid Ejector.

withdrawn by the powerful extracting leverage of the fore-end cam engaging with extractor legs, and the cases being taper, and moreover contracted after firing, the ejecting is effected perfectly.

The beauty of the mechanism lies in the fact that the gun opens easily and *smoothly*, nothing approaching a *jerk* being felt, whilst only the fired case is *ejected*. Greater cleanliness, speed, facility in loading, and general handiness, are amongst the advantages of the self-acting over other hammerless guns.

If considered desirable, the gun can be converted into an ordinary hammerless gun by substituting a pair of *extractors* for the *ejectors*, which is only the work of a few minutes.

The illustration, Fig. 246, shows the general appearance and action of

the gun, and the simple mechanism by which the cocking and ejecting is effected. A strong hinge-pin is used, and the barrels firmly secured to the breech-action by a through wedge-top and bottom bolt; a perfect hook is on the fore barrel-lump, as shown in Fig. 247, which also shows the circular-jointed under barrel-lump, and the action of the ejector-cams upon the legs of the extractors. Compare it with the cut, Fig. 248, which represents a section of the breech-ends of the barrels of an ejecting top-lever hammer or hammerless gun sometimes offered for sale in London shops. The original of this latter is the Joseph Needham ejector, which, to suit the exigencies of popular demand, instead of being manufactured with under-lever, as required by the patentee to aid in smoothly manipulating his gun, is made with an ordinary top-lever breech-action, the barrels and ejectors of the original form being retained, whilst the complete efficiency of the Needham under-lever, or the Greener top-combination, is wanting.

No other practicable double barrel ejector guns are extant.

HAMMERLESS GUNS COCKED BY THE MAINSPRING.

To ease the strain of cocking hammerless guns when opening or closing the gun, several plans have been devised. Possibly the ordinary rebound principle—to half-bent only—was employed in hammerless guns with this intent. If so the notion was false, as a stronger mainspring had ultimately to be overcome. More successful from this standpoint are systems in which the alteration of the position of the mainspring or its fulcrum is a basis to ease the hand-strain of cocking. To date of writing, three systems employing one or other of these principles are known to us. The first is by Tolley's Patent (Specification No. 461, 1877), now lapsed. The principle here employed is the use of a sliding main-spring, and a narrowing or > tumbler; the tumbler-pivot is situate between the mouth and inner extremity of the >; each arm of the mainspring is provided with a roller, and the mainspring itself is in connection with the barrels, from which, by means of cam, connecting-rod, or other gear, it receives a longitudinal motion; on opening the gun the mainspring is drawn away from the tumbler, and immediately its arm is past the tumbler-pivot it presses up the incline and thus cocks the lock; on closing the barrels the mainspring is pushed toward the tumbler and past its centre pivot. This

system is capable of being worked out to a successful issue, but in its present crude form is almost unworkable. It is the first system in which the *closing* of the barrels cramps the mainspring after the lock has been cocked. The other two systems are worthy of greater detail.

PURDEY'S HAMMERLESS GUN.

This deservedly-successful gun has the ingenious cocking mechanism of Beesley's Patent (No. 31, 1880), and is illustrated in Fig. A. The principle employed is a spring having two arms, one of which is stronger than

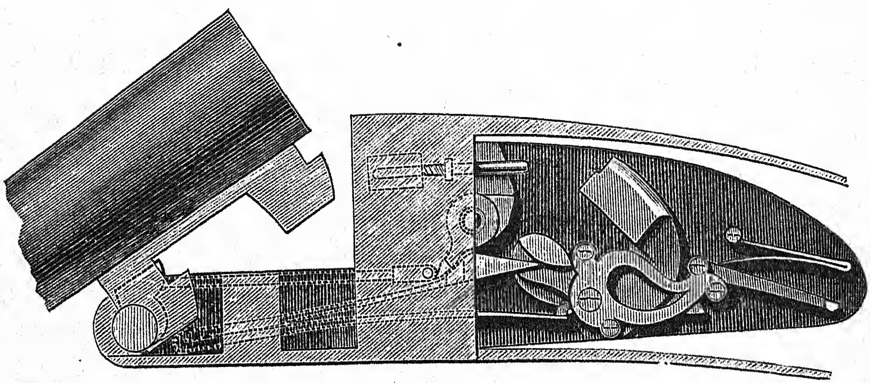


Fig. A.—Purdey's Hammerless Gun.

the other, the stronger cocking the lock, the weaker firing it; the stronger arm being thrown out of gear by a cam when closing the barrels, and remaining thus disconnected from the lock so long as the gun is closed.

As will be observed in the illustration, the upper limb of the V mainspring is much heavier and stronger than the lower, its extremity bears against a prolongation of the tumbler, and acts upon it as does the upper arm of the mainspring in an ordinary rebounding gun-lock. This arm is ungeared from the lock-tumbler by depression. On closing the barrels, the cam projecting through the breech-action bed is forced downward and backward on its centre, and by eccentric movement depresses the main-

spring. The mainspring is thus further cramped, and additional strength thereby transferred to its lower arm. On opening the gun the stronger arm overcomes the lower, and forces the tumbler into full bent, whilst it exerts further strength on the action cams, and so greatly tends to open the gun and withdraw the extraction.

Guns on this principle require careful and accurate workmanship; the principle is sound, and quite safe with an ordinary trigger-bolting safety. A gun may be constructed of tasty appearance, and the symmetry of an ordinary bar-lock gun retained. Its main drawback is hardness in closing, and expense of accurately manufacturing.

THE WALKER HAMMERLESS GUN.

This system is like unto the preceding so far as the cramping of the mainspring goes, but the arrangement of the parts is entirely different

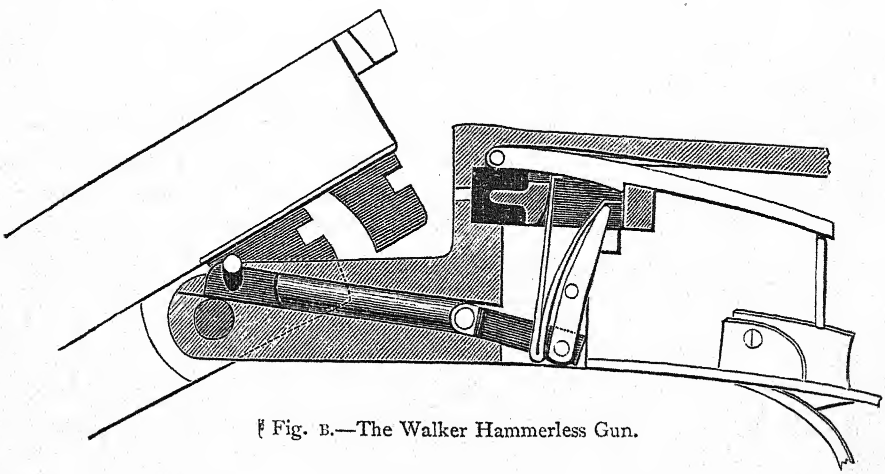


Fig. B.—The Walker Hammerless Gun.

as illustrated; the V mainspring is situate vertically behind the breech-action body, whilst simply prolonging backwards the horizontal striking-pin and notching it, it does duty as a tumbler.

The mainspring, when the gun is open, is extended; and by pressure against the central resistance of the vertical cramping-lever and striking-

pin, the latter is thereby withdrawn from the face of the breech until it is past a reversed scear pivoted over the striking-pin and spring. On closing the gun, the vertical cramping-lever has its lower arm pressed backward by the connecting-rod running through the body of the breech-action to the under-flats of the barrels. The upper arm of the cramping-lever compresses the mainspring, the whole force of which then reverts to the forward bearing on the striking-pin, and its whole energy is available for driving the striker against the cartridge-cap. The scear lies under the tang of the breech-action, and is lifted by a deep-bladed trigger.

Other arrangements are claimed in this patent (No. 1872, 1881); for instance, the half-cocking only of the tumbler-striker, the compression of the spring by the action-bolt, and also varied shapes of tumblers and scears; but the foregoing description is the gist of this invention, which is in many parts of a novel character and applied to sporting guns with satisfactory results. In common with the preceding system, guns so built are liable to strain the wrist uncomfortably when closing them.

HAMMERLESS GUNS OF DIVERS SYSTEMS.

The late unqualified success of hammerless guns has produced multifarious plans for cocking. To enumerate these varieties would be almost inutile, so many belonging to the same order, varying from recognised types only in minute detail. The numerous cheap hammerless guns advertised under special names are for the most part dependent on the "Murcott" principle for their cocking system; others follow the "Greener" club, and later ones are closely allied to the "Anson and Deeley." Leading types have already been illustrated, and described at some length. It is not our intention to review the specialties of gun-dealers who buy guns of Birmingham makers, dub them with a fancy name, and offer them as *bonâ fide* productions.

A few of the London makers—but *very* few—are possessed of hammerless systems, their own inventions, or sole property. A passing word upon some of these. Mr. Stephen Grant's hammerless gun has its lock mechanism arranged on the trigger-plate; the strikers are forced on to the cap by horizontally-sliding rods, around which are coiled mainsprings. The cocking is effected by a side lever. The gun as made by Mr. Grant,

is safe and durable. Mr. Lancaster's four-barrelled gun is fixed and cocked by mechanism exactly similar to the old Elliot pistol: a weapon enjoying a large sale and fairly good reputation before the introduction of Colt's revolver. There is but one mainspring; the trigger is a lifter, as in revolvers; the lifter is connected with a headed striking-rod, which is revolved by a ratchet arrangement, and comes into contact with the strikers successively. The length of draw in the trigger, the hardness thereof, the weight and general cumbersomeness of a four-barrelled weapon, all militate against its general adoption for winged game shooting. The illustration represents the later model with an extra trigger for cocking. Mr. Gye's latest gun, "an entirely new invention," is different in construction to any sporting gun in use; but, unfortunately, it does not amplify the redundant second title given to it. In short, a mechanism very similar exists on an ancient wall-piece preserved in the Paris Musèe des Invalides; not that this militates in any way against the value of the gun itself, the validity of the patent by which it is protected, or the credit due to the inventor, who has certainly produced a workable, and strong sporting gun, widely different from any system now offered for sale, and one to which all will wish every success.

Fig. D represents an outside top-view ot this strange weapon, and the hands indicate its manipulation. The mechanism is of the simplest: fixed barrels, a movable breech-block sliding in a cycloidal groove, a catch-stud to force the mainspring back and strikers into bent, and a projecting lever to actuate extractor. Its simplicity is a recommendation; so is the strength of its various parts. Its novel manipulation will be the strongest militant to its popularity; the method of extraction is open to improvement, as the necessary projecting lever is an eyesore to an otherwise perfect contour, though opinion may differ on this point, a facetious sportsman having pronounced the "Gye" gun to be a "Guy."

Several hammerless guns recently patented are possessed of no striking originality of mechanism, and are but combinations of separate known systems, or some improved mechanism applied to worked systems.

The Woodward "Automaton" Hammerless is the "Murcott," with a cocking-crutch geared on the upper arm of breech-action lever. The Gibbs and Pitt system, with a double-armed bolt, is the basis of many later guns, in some of which the bolt is forced back by the barrels, in

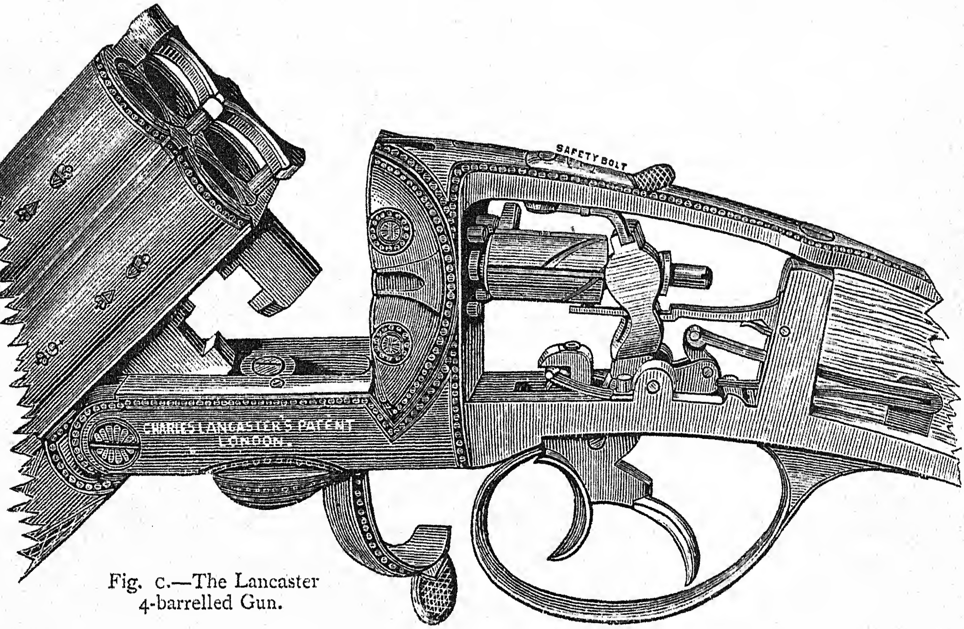


Fig. C.—The Lancaster 4-barrelled Gun.

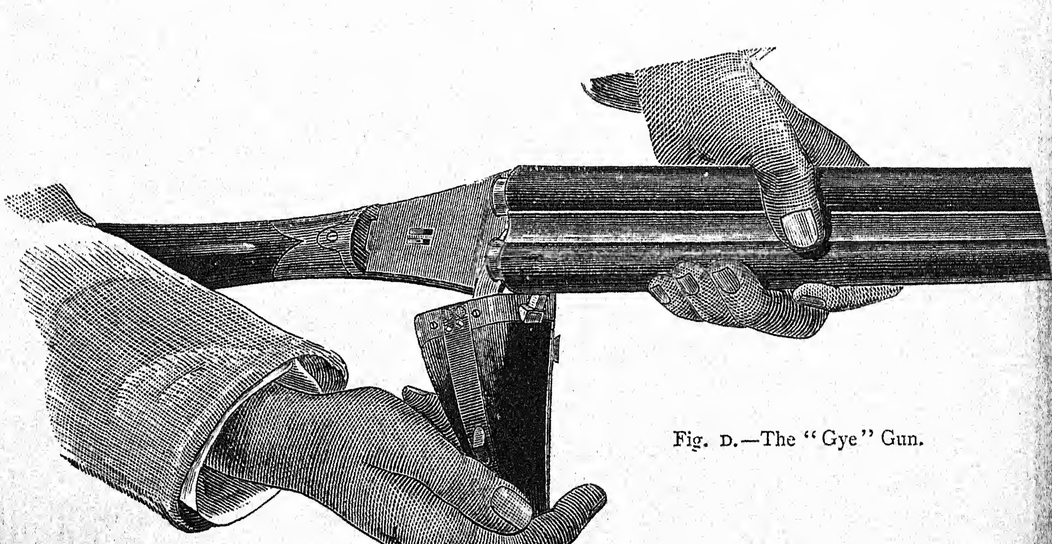


Fig. D.—The "Gye" Gun.

others is drawn by gearing from the breech-action lever. In the Tisdall hammerless a rachet and cogged arc on the lever-spindle withdraw it, and J. and W. Tolley used it in their hammerless gun in conjunction with a top-lever; the Leeson "Invicta" and Cogswell and Harrison's "Desideratum" are also based on the same contact of breech-action bolt and tumblers for cocking. There are also two patents by Scotch gunmakers for variations of the same principle. The hammerless gun of Alex. Henry is cocked by a "bi-furcated" lever "linked" to a "crank" actuated by an eccentric on cylindrical pivot of the under double-grip lever. The intermediate mechanism is to gain leverage; but the system is complicated, and certainly not superior to S. B. Allport's Double-grip Hammerless Gun illustrated in Fig. 233. Rogers' system is the well-known Anson and Deeley, with side locks, and the cocking dogs bearing directly against the barrels in lieu of being embedded in the fore-end, and, the barrels and cocking dogs turning on different centres, the gun is most disagreeable to cock. Enos James' Hammerless Gun is the "Greener Club" shown in Fig. 227a, with a cocking-lever interposed between the action-bolt and the tumblers, thus altering the principle. To strike an original line in gun mechanisms is difficult, and plagiarism is one of the bugbears of the trade.

Of American hammerless guns we have seen none except the somewhat antiquated specimen Fig. 236, and know nothing. On the Continent several unpatented English models are made, the Anson and Deeley, Greener, and other popular patterns being the more frequently met with. The Continental gunmakers have done little towards the perfectionment of sporting guns since the days of Lefaucheux.

SAFETIES.

With well-made locks, and of sufficiently strong and simple mechanism as not to get out of order, a safety-bolt is only useful to hammerless guns in order to take the place of half cock. In shooting dangerous game, and generally in all shooting, the gun is carried at full cock, whether it be hammerless or not, therefore the locks must be efficient, so that they will remain at full cock until disengaged by the trigger. It is evident, then, that a trigger-bolting safety is all that is required, and the simpler it is the

better. We know of no form more simple, convenient, or effective than our patent side safety-bolt, shown upon our hammerless gun in Fig. 242, and already described.

Messrs. Westley Richards and Co., when they first introduced the Anson and Deeley hammerless gun, used a self-acting tumbler-bolting safety, but quickly changed it for the automatic trigger-bolting safety shewn in Fig. 241, which they still use.

The Anson and Deeley lock being so strong and simple, it is impossible for it to get out of order or accidentally explode the cap. To such a gun, therefore, a safety-bolt is but a superfluity, as fully proved by the fact that Dr. Carver shot over 120,000 times from one of these guns without safety of

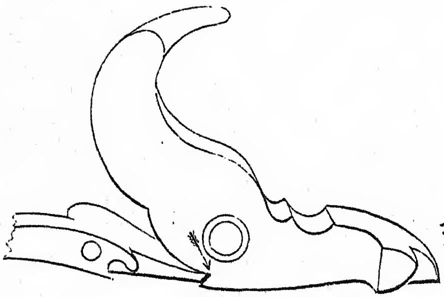


Fig. E.—A Right Bent.

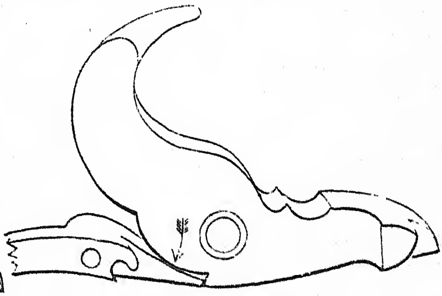


Fig. F.—A Wrong Bent.

any kind, and never had the least trouble or accident with the lock-work, although but cleaned once during the whole period.

The safety and durability of a lock is dependent on the shape of the bent. Taking, for an instance, the tumbler and scear of the self-acting gun, Fig. 246, the two adjoined cuts shew the bearing of the scear rightly, and wrongly. A bent shaped as Fig. E, of such depth, and with the centres of both tumbler and scear in proper relation, will never jar off; the work, however, is so fine, that many guns on Anson and Deeley, and other systems, are made as Fig. F, the body as well as nose of the scear in contact with the tumbler, any gun in which scear and tumbler are so shaped or arranged as to permit of contact of anything but the nose of the scear in the tumbler-bent are liable to be jarred off by extraneous blows, or the firing of one barrel. When the Anson and Deeley, or other guns of like mechanism, have gone off unawares, or both barrels together, we are in-

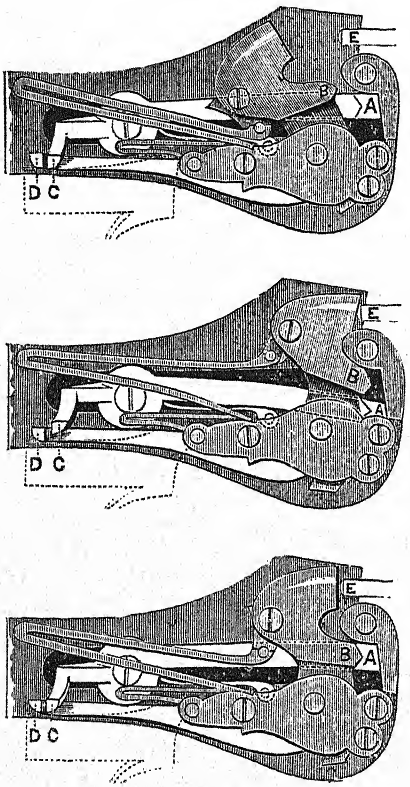
clined to believe that in most cases it is for this fault, but certain it is that such accidents arise from faulty workmanship, not from any fault of the principle.

The gunmakers who advertise and make guns with complicated safety-bolts under high-sounding names acknowledge the weakness of their locks, or their liability to accidentally explode the cap, and endeavour to prevent it by providing a self-acting catch on which the tumbler may lodge, unless the catch itself becomes deranged or freed by pressing the trigger.

Some also attempt to make the gun doubly sure by bolting the trigger in addition. The whole complication of the lock-work and safeties in reality render the gun far more unsafe and liable to get out of order than a strongly-made lock on the Anson and Deeley principle, though, of course, by well advertising the *improvement*, nervous sportsmen readily believe at first sight that the principle is a sound one. Trigger-bolting safeties and a strong lock are, therefore, the only reliable safeguards in which a sportsman may trust ; but as we have already stated, the former in careful hands is only a convenience at the most, and in our opinion it should not be automatic in its action. It certainly is a great nuisance on pulling at the triggers during a pigeon match and finding them bolted, and the bird over the boundary before the *automatic* (?) bolt is moved from safe, which we have seen ; with an independent safety the triggers may be bolted before the gun is loaded if desired, but such a course is unnecessary in ordinary shooting.

An instance in which a safety proved dangerous occurred recently. A party in India were elephant hunting. One, a well-tried sportsman and known elephant-killer, with a gun by an eminent maker, had a splendid chance of dropping a wounded tusker. He aimed, and the elephant, seeing him, charged. To the surprise of his brother sportsmen—who were hastening to the finish—he dropped his rifle without firing, and beat an ignominious retreat behind a friendly boulder, dodging the elephant until the others arrived to his assistance. The result proved that he, a cool and expert hunter of dangerous game, had neglected to unbolt the safety, and he acknowledged that it had been an element of danger to him instead of security. Some hammerless systems require safeties, automatic in their action, and intercepting tumbler or striker. Systems *necessitating* such safeties imply faulty construction or principle ; and, without

believing that the *raison d'être* of such automatic bolt, or second scear, is established, we can compare one such bolt with another, and appreciate existing good points. One of the first, best, simple, and effectual automatic safeties is the Scott. The three figs. show this safety fully, and illustrate the principle of automatic tumbler-bolting fully.



Scott's Automatic Intercepting Safety-Bolt.

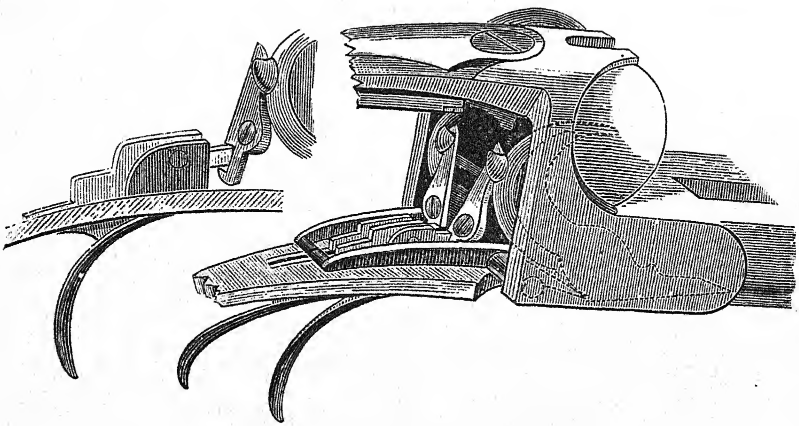
The construction consists of a pivoted lever, with its one extremity, C, projecting as a scear-tail over the trigger, the other extremity furnished with a stud, A, projecting in front of the tumbler-breast, B. The action is represented as follows:—First, the gun cocked and ready for firing, the scear-tail, D, and tail of safety-bolt, C, each waiting for the pull of the trigger to clear them from the tumbler. The trigger having been pulled, the pieces move to the positions next indicated; the stud on the rod, A, is carried free of the tumbler, and the striker, E, is fairly struck. Should anything occur to jar the scear out of bent, or for any reason the gun fail to cock when opened, the third figure illustrates the positions. The tumbler having slipped, is prevented from striking E by reason of the independent action of the intercepting bolt, leaving A undepressed and blocking B.

This bolt is simple, as reliable as any, and invaluable to the Scott Hammerless Gun, Fig. 230.

Other bolts to accomplish the same end are legion, all more or less complicated and effectual. Penn's and Tolley's are good examples of the intercepting bolt. Another safety closely allied to the preceding is the second scear. It exists in many

forms in the Powell, Anson's, Webley, and Greener Automatic Tumbler Safeties. The adjoined illustration shows the principle. A bolt so swung as to catch tumbler if it be jarred out of bent. On pulling the trigger the tumbler is cleared from both scears. Such bolting or double scearing makes an accidental discharge almost an impossibility, whilst the mechanism necessary need not be in the least complicated or detrimental to the strength of any part of the gun.

The silver safety is but a renovation of the old grip safety, as often seen on Manton's muzzle-loaders, but the gearing is modified to bolt-tumblers, scears, triggers, each or all. A safety actuated by pressure

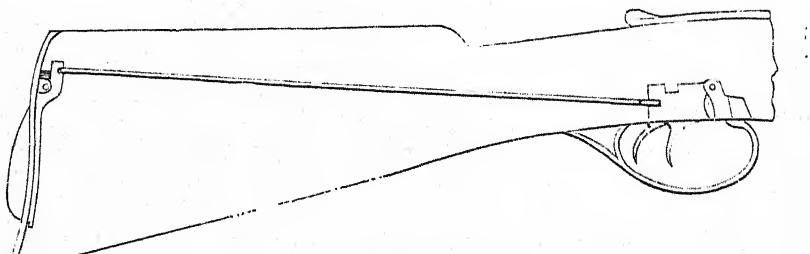


Greener's Automatic Tumbler Safety-Bolt.

on the grip seems to us next to useless, inasmuch as the gun is usually *gripped* when loaded. Automatic safeties, that is, self-acting both to bolt and unbolt, are still somewhat rare, since most now in use are made to act by pressing or working some lever or stud with the hand, and are situated upon the side of the lock-plate, or upon the hand of the gun, and all are more or less troublesome. To remedy this we have devised our patent shoulder safety-bolt, which may be constructed to bolt either the triggers or tumblers. By this simple contrivance the weapon is quite safe unless placed to the shoulder, or butt downwards on the ground.

It consists of a movable lever hinged on the butt plate, and working a horizontal rod connected with a bolting-lever, that slips over the triggers or into a notch in the tumblers. By means of a spring, this safety is always bolted until the lever in the butt plate is brought into contact with the shoulder, or pressed by other means. This renders all interference with the safety-bolts unnecessary, and makes the hammerless gun what it has always been considered to be, the safest, simplest, and easiest gun to use.

The only objection that can be raised to it is, that it is unbolted when left resting on the ground muzzle upwards, but arms should never under any circumstances be left loaded in any position, and with the breech-loader there can be no possible excuse for doing so. A gentleman left his gun leaning against a rock muzzle upwards, and went to luncheon which was spread at a distance of nearly forty yards from this gun. Unfortunately a dog knocked over the gun, and the charge of shot



Greener's Butt Safety Bolt.

reached the party with so great a force as to badly wound the owner of the gun, and entirely destroy the sight of one eye. With our butt safety this accident could not have occurred, as the gun would have bolted itself in the act of falling. It is the safety which we believe will give the most confidence to nervous sportsmen, and one that need *never* be thought of. The half cock of hammer guns was always considered a great nuisance, and hammerless guns were supposed to have dispensed with the evil; but automatic safeties requiring moving each time after loading the gun are every bit as troublesome as the raising of the hammers to full cock would be, and more bewildering to the sportsman not gifted with an excellent memory; for there are a great many who cannot tell, when a pigeon or covey rises, whether their gun is bolted or not.

All desirous of having automatic safeties, have a large field for choice; personally, we rely upon a simple trigger-bolting-safety, but have no wish to *force* this opinion on others. There are safeties, as Darby's, which automatically bolts tumblers and triggers, or scears, and liberates one lock at a time, but it is complicated though effective. In our opinion, a much more simple, ready and effectual means of accomplishing the same, is Allport's toggle bolt, though the action of this latter is upon the scears only. The safety which is shown on Fig. 233, consists of two vertically pivoted, crescent-shaped cams in juxtaposition, an inclined extremity on each meets a corresponding one on the scears, and the arrangement is such, that the movement of the top safety-stud closes both down on the scears, effectually locking them, and releases both; but although either may be fired, only one can be fired at a time.

This self-adjusting bit of mechanism is so simple as to commend itself for use on any gun where there is liability to jar off, and we make use of a modified form of this rocker or toggle on large rifles, or any we think, by reason of the use to which they may be put, are likely to meet with heavy and repeated jars. Complicated mechanisms—misnamed safeties—we are most careful to avoid, and have no wish to possess automatic bolts for the reason that at present they are fashionable.

ON THE CHOICE OF A HAMMERLESS GUN.

In addition to the foregoing bare descriptions of hammerless systems a concise, historical, and critical *résumé* of hammerless guns, enumerating the more salient features of the better known mechanisms, together with a few remarks as to their defects and advantages, may aid in arriving at a correct estimate of their relative worth.

Mr. Joseph Needham is accredited with producing the first English hammerless gun about 1856, the gun was not a success, possibly owing to its imperfect cartridge. For the next twelve years but little was done to improve hammerless guns. Daw's gun was not popular, and when, in 1871, Murcott's gun was produced the antipathy to arms of this description was strongly manifest. Murcott's gun had some success, but with the introduction of Needham's second gun, the first English barrel cocker, in 1874, the popularity of the hammerless gun was assured.

Numerous later developments of hammerless guns, in which the locks are raised to full cock by the breech-action lever, have remedied defects existing in the crude form of gun ; the principal being the amount of force requisite to move the lever, and the probability of the lever not going right home when the gun was closed, when the striker would fail to reach the cap, or reach it without sufficient force to explode it. Such guns as Allport's and Rigby's are free from these faults by reason of their perfected mechanism.

When the leverage of the barrels is employed to cock the gun, stronger main-springs, may advantageously be employed, and providing—as should be—that the cocking mechanism is distinct and in no way dependent upon the breech-action mechanism, a powerful blow on the cartridge cap can be ensured.

The Needham gun when first introduced did not meet with the success it merited and has since obtained. But the Anson and Deeley system, introduced in 1875, quickly became popular.

The cause of the latter's success may be looked for in the following facts: The system had merit ; its combination with a top lever made its manipulation easy ; it was introduced by the Westley Richard's Company, thus guaranteeing at least a *succès d'estime ;* its use was strenuously and unceasingly advocated by the author and other gunmakers known as the introducers of real improvements ; and lastly, it was the first good top lever hammerless gun.

The producers erred in supposing that the zenith had been reached. Good and better are ever inimical. In 1880 the author devised a new mechanism of cocking, employing a different principle to the Anson and Deeley. This mechanism is illustrated in Figs. 242, 243, and gave rise to the action at law of "Couchman *v.* Greener," a *cause célèbre* of patent law. The case is of interest also to inventors, gunmakers, and any conversant with gun mechanisms.

Remarks from ourselves are unnecessary, but we append the "Field" report, with illustrations showing the difference in principles employed, and the judgments of the Lords Justices. Lord Justice Lindley remarked :—

"The scheme is different, the idea is different, that is to my mind so plain when you look at the guns and mechanism that it presents to me no difficulty in the matter ; n other words, I say the two guns are worked upon different ideas altogether."

Lord Justice Bowen also remarked :—

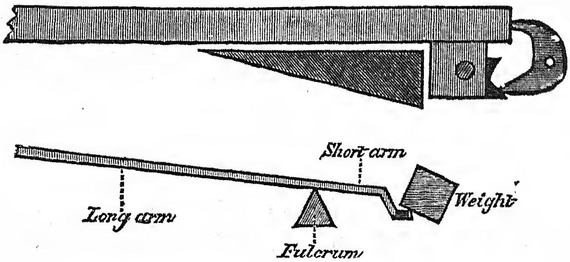
"With reference to the law of the case I entirely agree with what the Master of the Rolls has said, and the question resolves itself into one of fact. Juries sometimes are apt to be led away more hastily by similarities which are not similarities in principle. Treating the question as one of fact : do the defendants with the gun as made, use the fore-end as a lever ? That is a question of fact. Lord Justice Lindley has expressed my views most fully, and I agree entirely in the views expressed by him upon that point."

Couchman v. Greener.

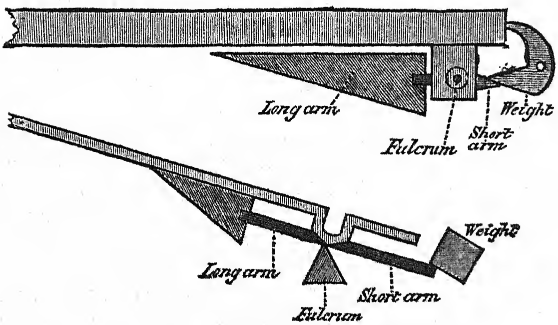
Reprinted from The Field *of April 21st, 1883.*

This case came on for hearing in the Appeal Court on Tuesday, the 10th, and Friday, the 13th inst. It will be remembered that Mr. Baron Pollock held, when the case was tried in the Court of Queen's Bench in November, 1881, that Mr. Greener's method of automatically cocking hammerless guns by means of a swivel or hook attached to the back bottom lump, and kept up to its work by a small stem, sliding through the lump itself and bearing against the fore-end, was not an infringement of the patent taken out in 1875 by Messrs. Anson and Deeley. In this latter, as is well known, the hammers are cocked by means of cocking levers, which work on the same fulcrum as that on which the barrels themselves turn, and which are received into sockets in the fore-end. The case was argued at considerable length before the Master of the Rolls and Lord Justices Lindley and Bowen in the Court of Appeal, the counsel engaged being the Attorney-General, Mr. Ashton, Q.C., and Mr. Macrory (instructed by Messrs. Wragge, Evans, and Co.) on behalf of the appellant plaintiffs, and Mr. Webster, Q.C., Mr. Clement Higgins, and Mr. Boyd (instructed by Mr. Holden) on behalf of Mr. Greener. The *casus belli* was a gun made by Mr. Greener, and shown by him to Mr. William Anson on Nov. 8, 1880, in which the cocking is effected by the arrangement above mentioned, and in which the fore-end is very slightly recessed where the sliding stem bears against it. This last detail was held not to be of any moment, inasmuch as it was admitted that there was no leverage action between the fore-end and the sliding stem ; and that the gun would work in exactly the same manner had there been simple contact merely. It was argued, on behalf of the respondent, that it was not new at the date of the plaintiff's patent to effect the cocking by means of the leverage which is brought into play on tilting the barrels to open the breech, and Mr. Needham's gun was put in to show this. That, this being so, all that the plaintiffs had protected by their patent was that part of the cocking mechanism which was combined with the leverage afforded by the barrels. This, according to their own specification, is a lever formed by the prolongation backwards of the fore-end beyond the hinge pin of the barrels, such lever working in a groove in the lump, the long arm being the fore-end, the short arm being the prolonged part of it, and the fulcrum being the same as that on which the barrels turn. It was pointed out that the mechanism which Mr. Greener had combined with the leverage afforded by the barrels was not a lever at all, but a to-and-fro movement in a horizontal plane ; and that, although the sliding stem might possibly be considered as a prolongation backward of the fore-end, it

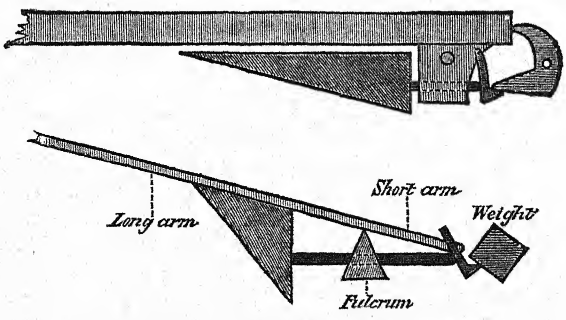
NEEDHAM'S PLAN.



ANSON AND DEELEY'S PLAN—LEVER WITH FIXED ABUTMENT.



PLAINTIFFS' TWO LEVERS.



DEFENDANT'S PLAN, WITH MOVABLE ADJUSTMENT.

was not a lever, but merely an abutment to give rigidity to the hook attached to the lump. This was illustrated by the introduction of a pin passed vertically into the lump through the sliding stem behind the hinge pin of the barrels, which had no effect upon the

cocking operation; a similar treatment of the plaintiff's mechanism having the effect of rendering it inoperative.

Their Lordships dismissed the appeal.

The Master of the Rolls said the question was whether, if there had been no license, the gun made and sold by the defendant would have been an infringement of the plaintiffs' patent. It would be immaterial for the defendant to say his gun would be within any previous patent, if it would also be within that of the plaintiffs. The previous patent could only be used to show what was the proper construction of the plaintiffs' patent. But the plaintiffs' patent was perfectly plain. The essential part of the combination of the lock mechanism claimed by the plaintiff was not only that the fore-arm should be used for the purpose of cocking, but that the forward part of it should be the long-arm of the lever. But, although that part of the defendant's gun was used for the purpose of cocking, yet it was not used as the long-arm of the lever, and was therefore not part of the combination claimed by the plaintiffs.

Lord Justices Lindley and Bowen also gave judgment in favour of the defendant.

[The annexed rough drawings show the differences between the plans of the plaintiff and defendant.—Ed.]

With respect to the relative merits of the two rival systems, the author would not have gone to the expense of patenting and defending his system —involving the risk of several thousands of pounds—were he not convinced of its superiority, a gun that cocks with less force and has a more perfect contour necessarily has the preference.

The durability of a hammerless gun, as of guns with hammers, is dependent upon the system employed and the workmanship. It has been stated that guns cocked by the barrels cause a greater strain upon the hinge than do those cocked by the lever, but the same authority holds that there is greater strain at the same point in guns cocked by the falling of the barrels than in those cocked by closing the gun. The difference is almost nil, but, if any, in favour of the gun that is cocked by the barrels falling.

Simplicity of mechanism, other things being equal, is durability and safety in hammerless guns. The fewer pieces in locking, cocking, or breech action mechanism the better. A snap-action gun is preferable to a double grip one, inasmuch as it is more commodable, and for the same reason is the top lever superior to under or side lever actions.

So far as regards safeties, it is useless to possess a gun in which the user has no confidence, worse to have one in which confidence is misplaced, and what should be an item of safety prove a peril. In this the better plan is to

decide whether one can be satisfied with no safety at all, as simple trigger safety, or an automatic tumbler safety; and if the latter, leave to a gun-maker of reputation the choice of the particular safety arrangement most applicable to the lock mechanism used. There are at least a dozen efficient automatic tumbler bolting safeties at his disposal, it will be to his credit to put the best, although he may think a safety superfluous and betraying a want of faith in his own good work.

Efficiency and general handiness are requisite in the gun of to-day. Speed, when compatible with safety and efficiency, is a desideratum, and here the ejector hammerless gun has a decided advantage.

The parts are few, distinct, and strong ; the gun is exceedingly handy and of perfect exterior, so that whilst possessing the good points of the best hammerless guns it has others.

There are hammerless guns with detachable locks, barrel cockers, as Scott's, that fill, or appear to fill, the ideal of some; others favour a special action lever, or even a four-barrelled gun. Four-barrelled sporting guns were made at St. Etienne so long ago as the sixteenth century, and their revival is not commendable from an artistic or game preserving point of view. This gun is cocked by the finger as a double-action revolver, and is not liked by the generality of English sportsmen. Of lever cockers that open easily, the Allport, the Tisdall, the Henry, and the Rigby have the palm, but the three latter have not the advantage of extreme simplicity. Avoid guns that almost break the wrist to open, and guns with weak main-springs.

Of barrel cockers the Greener, Scott, Purdey, and Anson and Deeley, are in the van for ease of manipulation and simplicity of construction.

In ejecting guns there is but little choice, either the original Needham or Greener's modification; other clumsy expedients have been patented that will never commend themselves to the intelligent.

ROOK, RABBIT, AND SALOON RIFLES.

For rook and rabbit-shooting small, single, breech-loading rifles are generally used. There are at the present time several sizes in the market. The original rook-rifle of ·380 bore, taking a metal case, 14 grs. powder and a conical bullet; the new ·360 Express rook-rifle, with a special, short,

metallic ·360 cartridge case, 14 grs. powder and conical bullet weighing 135 grs. with hollow point; and the ·320, taking an extra long ·320 metal case and conical bullet, with a charge of 10 grs. powder.

The breech-actions applicable to rook-rifles are the Martini, the top-

Fig. 249.—Top-lever Rook Rifle.

lever, the side-lever, and the Remington; the former are, however, the handier. We illustrate in Fig. 249 a top-lever rook and rabbit-rifle. It has the ordinary bottom holding-down bolt, half-pistol hand, rebounding lock, and octagon barrel. The extracting is effected by a strong lever on

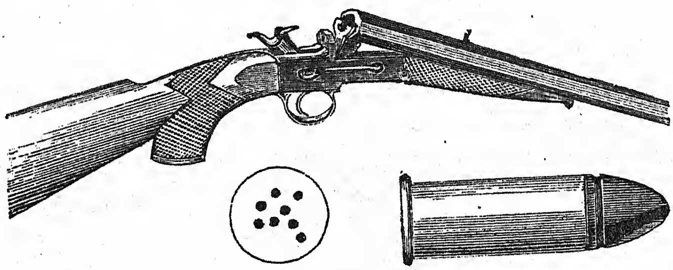


Fig. 250.—Side-lever Rook Rifle, and ·380 Long Cartridge.

the side of the breech-action engaging with the extractor, and it is simply impossible for it to get out of order or fail to withdraw the cartridge-case. This rifle is more expensive than the Martini rook-rifle.

These rifles have usually half or full pistol-hand stocks, but with side-lever action rook-rifles, the detached rebounding lock is substituted for a saddle pistol lock, as shown in Fig. 250. The lever is conveniently placed

upon the right side of the breech-action body, a lever, or pivoted extractor is employed, and the weapon is less expensive than the top-lever rifle. The ·380 long metal cartridge is also shown exact size, and a diagram of the shooting of the rifle at 100 yards, one-quarter size. Weight from 5 to 6½ lbs., but they may advantageously be made heavier, greater accuracy being thereby insured.

Rook-rifles are usually sighted to 150 or 200 yards, sometimes more. The short ·360 and the ·320 bores cannot be considered accurate beyond 100 yards, but at short distances they are perfect. The ·380 with the solid bullet is accurate and effective up to 200 yards. For naturalists these rifles offer special advantages, as the skin is only broken in one place, and the range is great and enables the collector to add to his bag many specimens that could not be obtained with a shot gun. Pea-fowl, flamingoes, bustards, wallaby, and most of the smaller mammalia, are more readily obtained with their aid than with all the collection of walking-stick guns, ·410 shot guns, &c.

A top-lever hammerless Rook rifle has been introduced by Messrs. Holland and Holland. The annexed illustrations show the mechanism, which is most simple, and the general appearance of the arm.

The principle consists in the compressing of the flat main-spring by the pressure on its stud, *b*, of a slotted cylinder, *a*, actuated by the top-lever. On opening the rifle the two planes on *a* and *b* are brought into contact, and the tumbler, *c*, thereby forced to full cock. A safety on the side bolts the tumbler or striker. Messrs. Holland advocate the ·295 bore in preference to larger sizes for rook shooting, and for that purpose it has advantages, the range being sufficient, but the small charge of powder used renders it useless for many purposes the ·360 or ·380 bores were designed for. The accuracy of rook rifles has already been treated of under the heading of "Sporting Rifles."

Walking-stick guns, as usually made in Belgium and France and sold in quantities in London, are, like most other combination weapons, not much use either as guns or walking-sticks. The tube inside the cane is frequently of *inferior iron or brass*, and brazed together from end to end. We have seen several that have burst with the ordinary load, and as the mechanism is poor both in principle and quality, it is only a wonder that accidents with them are not more numerous.

Saloon rifles, incorrectly so termed, are small, smooth-bore guns, with very strong, heavy barrels, and firing a bulleted breech-cap. They are made in three sizes known as Nos. 1, 2, and 3, the diameter being 1-8th, 3-16th, and 1-4th inches. The smaller sizes generally require no breech-action, the strength of the mainspring and weight of the broad-nosed hammer being sufficient to prevent the escape of gas at the breech. The

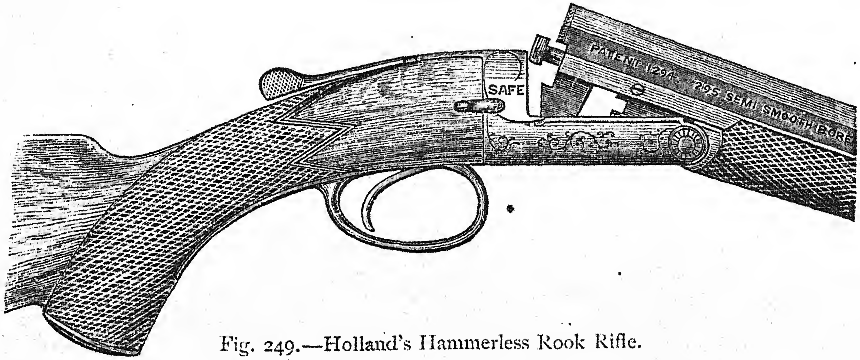


Fig. 249.—Holland's Hammerless Rook Rifle.

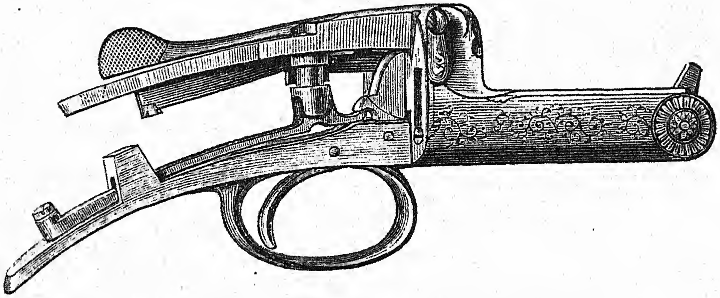


Fig. 250.—Mechanism of Hammerless Rook Rifle.

larger is pivoted on a hinge-pin similar to the side-lever rook-rifle, the bolt being actuated by a small lever on the side or underneath the breech-action.

Their range is 50 to 100 feet, and they are very accurate at close quarters.

Pistols of the same sizes are also made on the same principle. In all saloon rifles and pistols the propellant is fulminating powder contained in

a small copper case, the invention, we believe, of M. Flobert, whose name is the best known in connection with these arms.

As an instance of the remarkable precision of miniature rifles and pistols, we may mention that Mr. Lord, a professional pistol-shot of New York, has frequently fired a ·230 bullet through the ring of a 100 dollar watch, the watch being suspended at thirty feet.

A small ·230 Ballard rifle, at seventy-five feet, has put ten consecutive shots within a centre of 1 th inch diameter; this is considered the best performance yet accomplished, and was made off-hand by a professional marksman.

The cartridges are most carefully made by the Winchester Arms Company for these small *carabines de précision*, and are used in considerable quantities by clubs and in private practice.

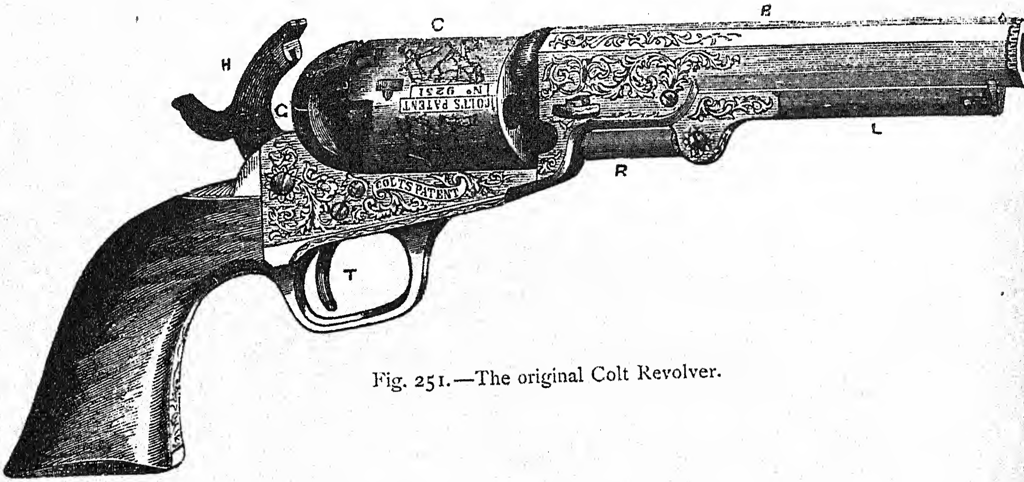


Fig. 251.—The original Colt Revolver.

BREECH-LOADING REVOLVERS.

The difference between ancient and modern revolvers consists mainly in the fact that the chambers of the former were rotated by the hand, whilst in the latter the rotary motion is conveyed by the trigger or the hammer. With the first we have already dealt, and the latter appears to have been introduced about 1814, but in a very crude and indefinite form. In 1818 Collier used a separate spring to rotate the chamber.

Colonel Colt, when patenting his pistol in 1835, claimed more particularly the central-fire ignition than the ratchet motion of rotating the chamber. His revolver we illustrate in Fig. 251. Previous to its introduction, a six-barrelled revolving pistol, known as the "pepper-box," was largely manufactured. The hammer was upon the top, the motion of the trigger serving to raise the cock and rotate the barrels.

Many imitations of Colt's central-fire revolver were produced, but his was preferred, being generally heavier and better made. Colonel Colt also demonstrated the practical advantage of conical bullets for revolvers; previous to his time, spherical bullets were mostly used.

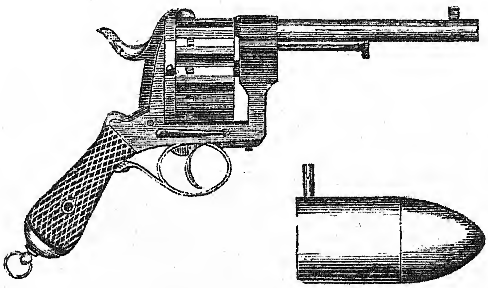


Fig. 252.—Ten-shot Lefaucheux Revolver.

About 1850 to 1855, the English gunmakers effected several improvements in the mechanism of revolvers, which, together with better workmanship, asserted the supremacy of the English revolver. About 1855 the double-action revolver was produced: Adams's, of London, and Tranter's double-trigger revolver attained a good reputation, the systems being subsequently modified to suit breech-loading revolvers, the credit of introducing which is assigned to M. Lefaucheux. In his system a pin-fire cartridge case was employed, similar to that used in the Lefaucheux gun, of paper with metal base, or of metal foil. The sizes usually made were 5, 7, 10 and 12 shot, the calibres being 5, 7, 9 and 12 millimètres. We illustrate a 10-shot Lefaucheux Revolver in Fig. 252, with 12 millimètre pin-cartridge.

The next improvement was of American origin; it consisted in having the cartridge case of solid drawn metal, the ignition being in the rim. This

system was doubtless developed from the French Flobert saloon-rifle cartridge, the only difference being in the size, and the fulminating powder placed in the rim, instead of filling the cartridge case, as in the Flobert. We show this revolver in Fig. 253; the size is ·320, and the shape will convey a relative idea as to the size and appearance of the American "Six-shooter," of which it is a fair type. The revolvers usually sold in England are of ·450 bore, five or six shot. The patterns are various, the best being

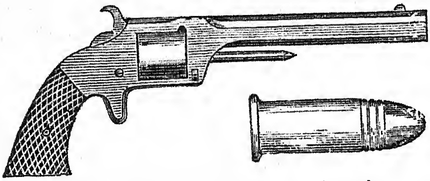


Fig. 253.—Smith and Wesson's American Six-shot Revolver.

THE IRISH CONSTABULARY REVOLVER.

The bore of this is ·450, with a moderately short barrel, which makes it light and handy, with the advantage of a large bore; it is double-action,

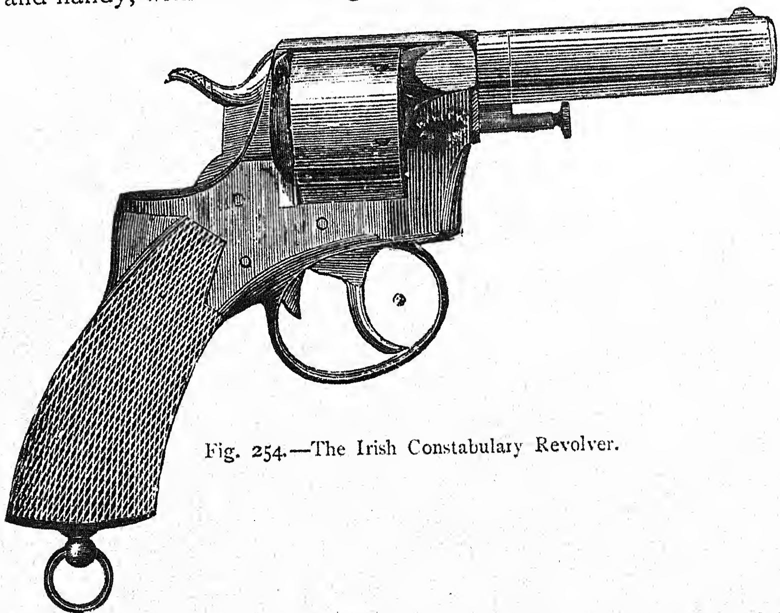


Fig. 254.—The Irish Constabulary Revolver.

can be cocked with the thumb or by pulling the trigger when rapid firing is required. This is a very reliable revolver, and can be depended upon if of

English make; but there are many sold in this country of Belgian manufacture, at about half the cost, and frequently bear the Birmingham proof-mark.

There is also a revolver made to take the Boxer cartridge case, ·577, and a spherical ball, twenty-four to the pound. This is decidedly a most formidable weapon. It has six chambers, and weighs only 2 lb. 14 oz.

THE GREENER BULL-DOG REVOLVER.

This revolver takes the regulation cartridge ·450-bore, and weighs only 18 ozs.; the entire length is 7 inches. This is the lightest revolver that can be made for so large a bore. It has a well-shaped stock or grip, which

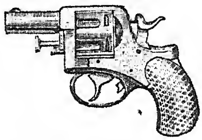


Fig. 255.—Greener's Bull-dog Revolver.

makes it convenient to handle, and very portable, and suitable for the pocket, and most accurate up to 30 yards. The smallest English pistol made is the ·230 rim-fire, weighing 7 ozs., and about 6 inches long.

ADAMS' PATENT CENTRAL-FIRE BREECH-LOADING REVOLVER.

This revolver has six chambers. It can be cocked for deliberate aim, or discharged in rapid succession by merely pulling the trigger.

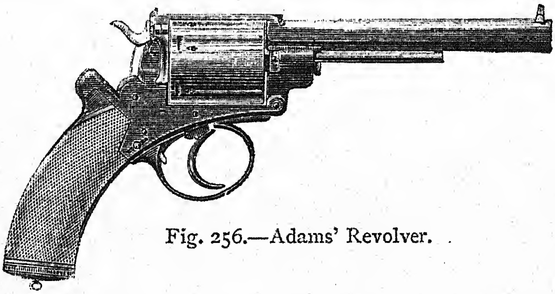


Fig. 256.—Adams' Revolver.

This is a strong, large, heavy pistol for horseback use, and is the regulation army pattern.

THE TRANTER REVOLVER.

This is very similar to the Adams'; it is central-fire, made in two sizes —·380 and ·450; the workmanship is very good, and they may all be relied on for accuracy. All the breech-loading revolvers we have described have the ordinary swivel ramrod attached to the barrel to extract the fired cartridge cases.

THE NEW COLT REVOLVER.

The Colt's Arms Company have recently introduced several new patterns of double-action revolvers. The shape resembles the original Colt Revolver, and the cartridge cases are removed after firing, by working a rammer placed beneath the barrel.

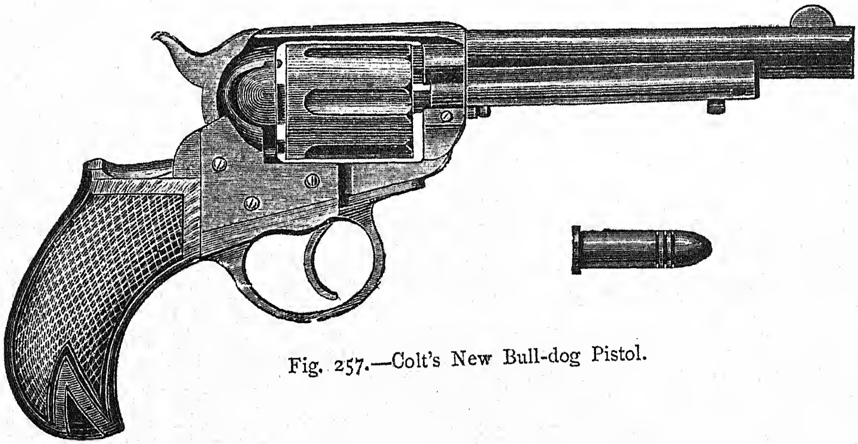


Fig. 257.—Colt's New Bull-dog Pistol.

We illustrate one of the smaller models in Fig. 257. It is known as the "Bull-dog" and takes the ·380 long cartridge; other sizes, as ·410, ·442, and ·450 are made, but they are heavier and more cumbrous than the English patterns.

All these revolvers are expensive, and as they are not self-extracting, English revolvers of the best make are preferred to them, and they are also much more handy

SELF-EXTRACTING REVOLVERS.

The idea of making revolvers self-extracting appears to have originated with M. Galand, a Belgian maker, but his ideas were rapidly improved upon. Amongst the earlier self-extracting revolvers was the "Thomas," which we illustrate in Fig. 258; by turning over the barrel and forcing it forward an inch and a half, the fired cases are ejected as shown.

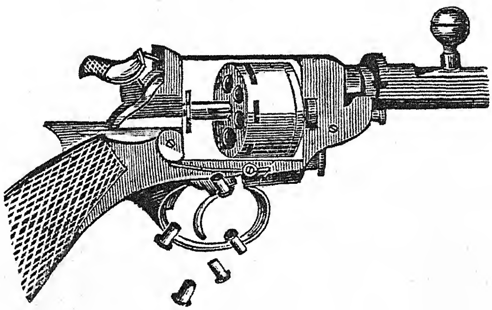


Fig. 258.—Thomas's Self-extracting Revolver.

This is accomplished by having the barrel and chamber to slide along the chamber spindle and body of the pistol; the extractor being fast to the spindle retains the cartridge cases until the chamber is clear of them. A further improvement is the "Self-extracting Revolver." This principle of ejecting the cases originated, we believe, with Messrs. Smith and Wesson, of the United States, but it has been improved upon considerably both in England and Belgium.

We illustrate one of the improved revolvers in Fig. 259. The improvement mainly consists in the method of making fast the barrel and chambers to the pistol body and in the employment of a rebounding cock.

Large quantities of these revolvers are made in Belgium in imitation of our "Bull-dog" and "Irish Constabulary" models.

The English Army Revolver made upon this system we believe to be the most efficient revolver produced, and the easiest to manipulate. It is of large size, with 5½-inch barrel, ·450 bore, with six chambers, and weighs

31 oz. The advantages presented by the self-extracting revolver are, the rapidity with which it can be loaded and unloaded, its great safety, and the ease with which it can be cleaned or opened to see how many cartridges have been fired. The new model takes the ·455 cartridge, with 18 grs., and hardened bullet of 265 grs., and has an accurate range to 30 yards.

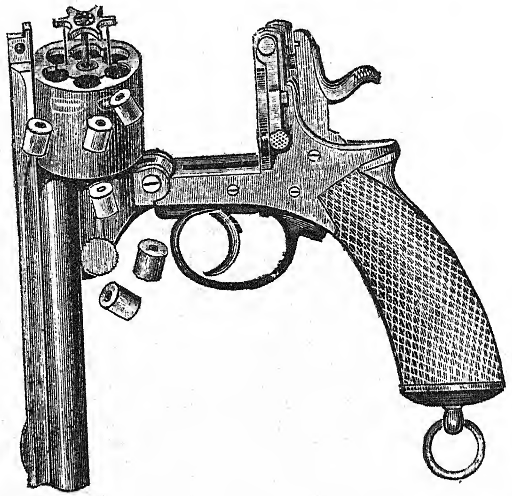


Fig. 259.—Self-extracting Safety Revolver.

Self-extracting revolvers are rapidly gaining in favour both in America and Europe, and the double-action revolver meets with increasing popularity in the United States.

BREECH-LOADING PISTOLS.

Pistols have for some years been superseded by revolvers, but there is just now the possibility of their again coming into favour.

The only breech-loading pistols not affected by revolvers are the small pocket-pistol, and the heavy, double-barrelled horse-pistol.

Of the former, the two patterns shown in Figs. 260 and 261 are most in request. Fig. 260 is the well-known Colt Derringer single-barrelled pistol of ·41 calibre.

Fig. 261 is a double under-and-over Derringer pistol, ·41 calibre; the total length is under five inches the barrels being three inches long. The weight is 11 oz., rim-fire cartridge exact size of illustration.

To fire the second or lower barrel, the head of cock is turned over with the finger.

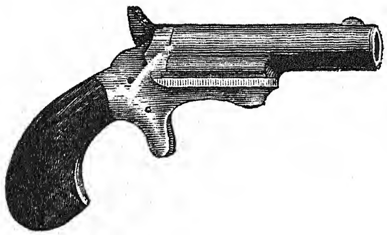


Fig. 260.—Colt's Derringer Pistol.

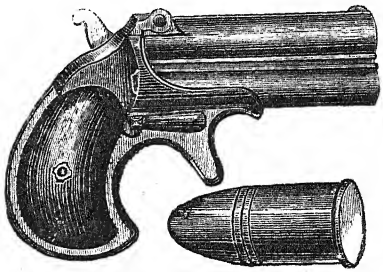


Fig. 261.—Double-repeating Derringer Pistol.

The large, double horse-pistols used for buffalo-shooting in America are of ·577 bore, and usually have double-grip action, as Fig. 262.

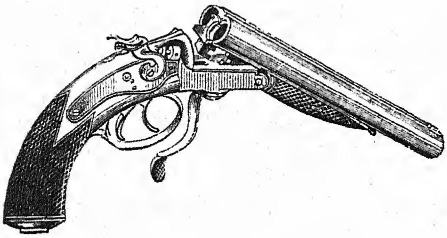


Fig. 262.—The Double-grip Saddle Pistol.

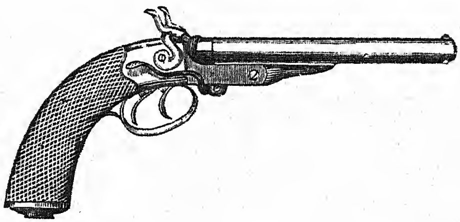


Fig. 263.—Side-lever action Saddle Pistol.

They are sometimes, however, made with side-lever action, as Fig. 263; they take the Snider case and spherical bullet; the barrels are about six inches long. These pistols are generally made in pairs for the saddle-holsters, and weigh about $3\frac{1}{2}$ lbs. each; they are clumsy but very effective weapons, and will take a charge of $1\frac{3}{4}$ drms. of powder without unpleasant recoil.

O*

THE "MITRAILLEUSE" PISTOL.

The production of this pistol has been long delayed. We illustrate it in Figs. 264 and 265, and the principle consists in having four or six barrels arranged in pairs, each pair laying on the other; there is a hinge-joint close

Fig. 264.—The Mitrailleuse Pistol (closed).

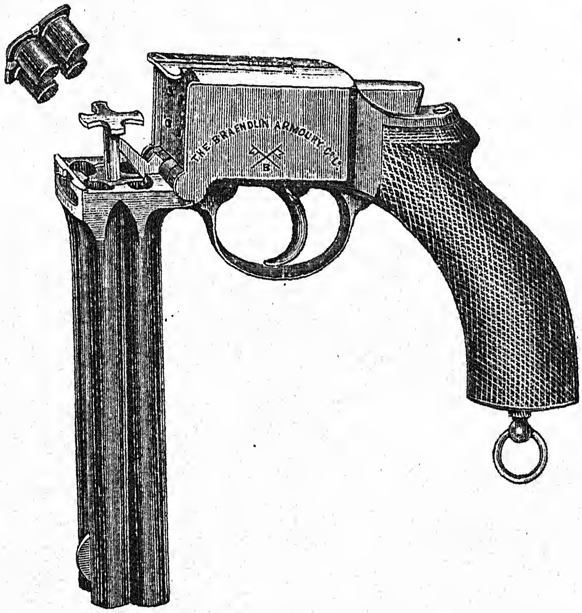


Fig. 265.—Pistol Open, and empty Cartridge Cases.

to the breech, and a top-fastening; each barrel has a separate striker and spring; there is but one trigger in connection with a vertical spindle

with projecting studs, so that by pulling the trigger the strikers are cocked and fired in rotation.

Our principle of joining the cartridge cases at the base (see Fig. 157) has been adopted, and the barrels lying more compact than the chambers of a revolver enables the united cases to be arranged in a smaller bunch.

It is claimed for this pistol that it will shoot more accurately, with more force, and will not foul so rapidly as a revolver; and in our opinion it has several advantages over the revolver that will commend it to sportsmen, and may eventually occasion it to supersede the revolver entirely.

The cocking is easy, the ejection perfect, and the firing rapid, as many as 44 shots per minute have been fired from it. The facility of loading is a great advantage, and as the weapon can never be laid aside cocked, it cannot very well be fired by accident. It is the best arm of its kind. Mr. Lancaster, owing to the tardy production of this pistol, has stolen a march upon the joint proprietors, and put on the market a weapon similar in lock mechanism to his gun shown on Page 401.

THE SHOOTING OF REVOLVERS AND PISTOLS.

Great accuracy with a revolver is not to be expected. There is a variable escape of gas as each successive chamber is fired, and the direct strain of the recoil is so far above the resistance—the hand—that steady shooting with the ordinary revolver is an impossibility. All are sufficiently accurate to hit a man at, say, 15 or 20 yards, but no fine shooting like that obtainable even from saloon pistols is possible.

The duelling pistol, as made by Gastume Renette of Paris, is capable of wonderfully accurate shooting. At sixteen paces there are no less than eleven persons who have put ten consecutive shots into a centre 3 centimetres in diameter, *without cutting the line.* One of the few persons who have accomplished this is Mr. Ira Paine, the renowned American pistol shot. He is a gold medallist amongst the duellers, and, with such a pistol, has made the best shooting ever recorded—putting ten consecutive shots with a mean deviation of only 0·39 inch, the pistol used taking a 9 millimetre spherical bullet and about 12 grs. of powder. With his ·230 pistol he has achieved greater wonders, cutting for the author a pencil line drawn on a playing card and fixed at 20 feet distance. He can also make sure of

piercing the ace of hearts at 30 feet twice out of three times, and repeatedly splits the edge of a card carried at right angles to himself and 20 feet distant. Such marvellous shooting may be a special gift, or the result of continuous practice, or both. The pistols used are rifled, and are seldom sufficiently accurate after two or three thousand rounds have been fired, the grooving being exceedingly fine. No difficulty, however, is experienced in duplicating them.

ECCENTRICITIES IN GUNMAKING.

It is our intention to notice now a few of the peculiar arms and mechanisms we have from time to time met with, and which may, we think, affect materially the gun of the future, besides directing future inventors, and, if possible, prevent them wasting both time and money by patenting inventions " as old as the hills ;" for we can assure amateur inventors that neither the patent laws nor the patent agents care that " —is possessed of a new and useful invention " as long as the necessary fees are paid, and the very same invention *may* and *has been* patented several times by different parties in a few months. This should not be so. In the United States, the patent commissioners institute a search amongst previous models and specifications before granting the patent, and yet the fees are not half so high, whilst the patent is of longer duration, and the patentee far more secure from infringements than in England, where one may patent almost anything, and, we very much regret to say, *where direct infringements* may be patented ; and so defective are the patent laws, that infringements are declared valid, whilst the original patent is not secure.

The high fees are also great drawbacks to inventors, especially the poorer mechanical genius, who has to save and pinch to obtain the necessary fees, and then, frequently through the negligence or ignorance of his patent agent, his invention, if a valuable one, is found to be inadequately described and consequently invalid. A less expensive court for trying patent cases would also be a great boon, and searchers for similar inventions amongst old patents should be employed, to guard against issuing two patents for the same invention. In time the searchers would constitute a body of experts, whose opinion on patent matters would be invaluable in law courts, especially before a non-mechanical Chief Justice.

In our opinion the gun of the future will be double-barrelled, but will certainly have but one trigger. The idea of making one trigger serve to discharge both locks occurred to us a short time ago, and we prepared to take a patent. Luckily, however, we discovered the old pistol illustrated in Fig. 266, and saved the £50 about to go to the Royal Exchequer, and ourselves much chagrin and annoyance—*Verbum sap.*

In this pistol the trigger is pivoted vertically ; an inclined plane on the right tumbler forces the trigger under the left scear, when the right tumbler

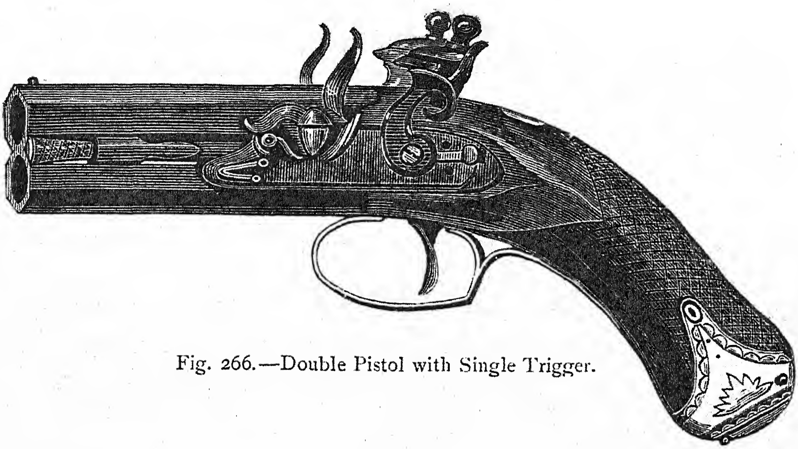


Fig. 266.—Double Pistol with Single Trigger.

has been let down ; on the tumbler being raised, a spring forces the trigger beneath the right scear. It is necessary to remove the pressure of the finger upon the trigger before the second barrel can be discharged, in the same manner as with a double-action revolver, but the pistol trigger does not require so much travel. This method of constructing guns is advocated in a German book on gun-making.

We accomplished the same end in two or three different ways, the most successful being a swivel pivoted vertically in the trigger-blade and actuated by the scear-tail and a small spring. We made two or three guns with one trigger, as shown in Fig. 267, but owing to a slight error in the principle we found that *with some persons* both barrels went off simultaneously; consequently we have not issued any guns so constructed, and the principle remains in *statu quo*, pending time to improve and perfect it.

Since the publication of the first edition of this book, a patent has actually been granted to a Birmingham inventor for the mechanism as here described. It is not a success, but even were it so, his patent could not

Fig. 267.—Greener's Double Gun with Single Trigger.

stand in a court of law, and the seal and specification, which has cost him some £30, is not worth a row of pins.

An electric gun, invented, we believe. by a French Baron, and of which sample guns were made many years ago at Prague, is shown in Fig. 267.. The electricity is generated in the stock of the gun, and is only employed to fire the charge. The gun is muzzle-loading.

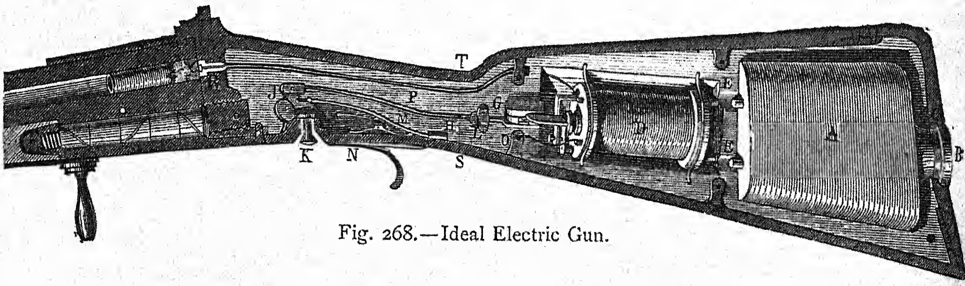


Fig. 268.—Ideal Electric Gun.

is an ordinary bi-chromate battery, filled by removing the plug B in the heel-plate C. D is an induction coil connected with A by the wire E E. This coil, when the battery is at work, vibrates most unpleasantly, so a small magnet is placed at F to prevent it. To generate the spark the button

K is pressed with the finger, this causes the nut J to partly turn, withdrawing the rod H to the guide L, and come in contact with a stop at O, and, by making the circuit O P R complete, fires the gun. M is a spring depressing the button K, whilst N is a safety cover to the button K. S F is the iron framework of the stock.

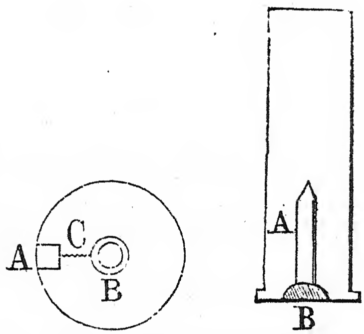
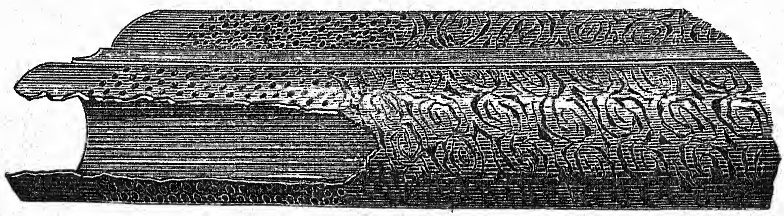


Fig. 269.—Electric Cartridge.

Amongst other advantages claimed for the gun are—impossibility for escape of gas at breech, safety, and speed.

The breech-loading electric gun of M. Pieper, of Liège, is solely dependent upon a battery carried separately from the gun by the shooter. A special jacket, or a pad to fasten on to the shooting coat, is necessary, and this pad is in connection with the generating battery or Faure store


Fig, 270.—Grooved and Perforated Shot Barrel.

coils. The heel-plate of the gun has a corresponding metal conductor, so that upon placing the gun to the shoulder the current is established. The

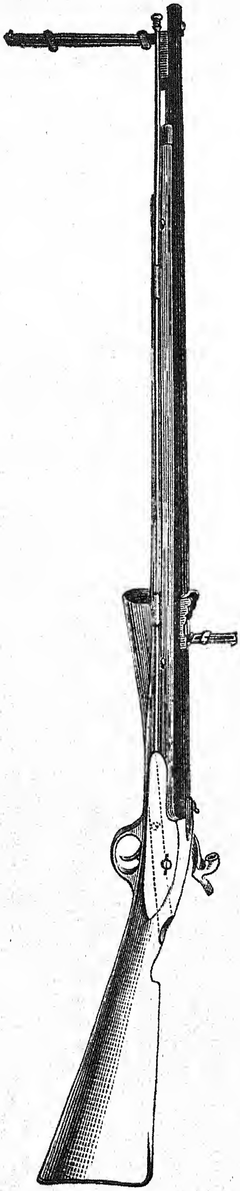


Fig. 271.—Reversely-sighted Enfield Rifle.

cartridge case is of metal (Fig. 269), and has extending from its base a stud, A, a wad with a metallic centre, B, and connected with a wire, C, with another stud, A, on the edge of the wad, is placed face downwards over the powder, and, on the trigger being pulled, the circuit of the current is established, the spark passing through the stud, A B, in the cartridge to the B in the wad.

It is no very difficult matter to ignite the charges by electricity; but the disadvantages of the battery are not compensated by the extra safety possessed by the cartridge, speed, or certainty of ignition. Electricity has not yet been employed in any way as a propellent in firearms.

Many Continental gunmakers seem determined that a shot barrel with straight grooves, similar to rifle grooves, improve the shooting. We have tried several, but could never find that the process improved the thickness of the pattern or regularity of the shooting, or in any way added to the value of the gun. The barrel, in addition, is often choked without any appreciable gain, and the whole inferior to the performance of ordinary choke-bore guns. The illustration shows a portion of the barrels of one of these Continental oddities. Both barrels also are thickly perforated a few inches from the muzzle, as shown, the idea being to lessen the recoil thereby. As an actual test we tried the gun against one of our own of equal weight, gauge, and length. The average recoil with the perforated gun was 11¼ lbs. in excess of ours, whilst the force on the "Field" gauge was less by an average of 1·087, and most irregular.

An arm recently in our possession we show in Fig. 271. It is an Enfield rifle, built for match-shooting, and purposely for reclining positions.

The sight is placed on the muzzle and beneath, and a hole is bored through the hand and fore-end to take the aim, and a small V back-sight inserted therein. The ordinary sights also are affixed for shooting at the nearer ranges.

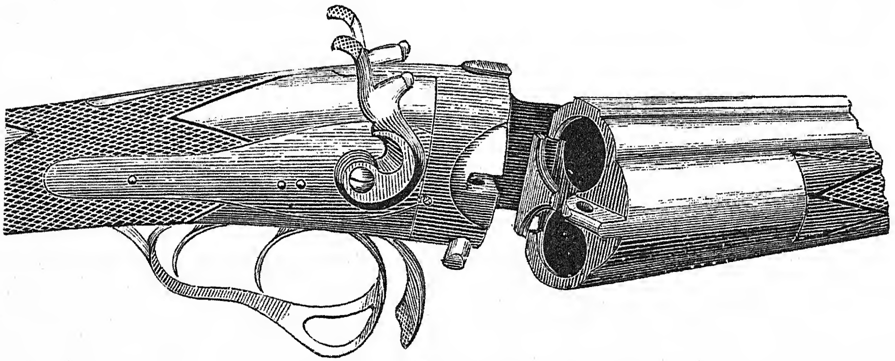


Fig. 272.—Under and Over Wedge-fast Gun.

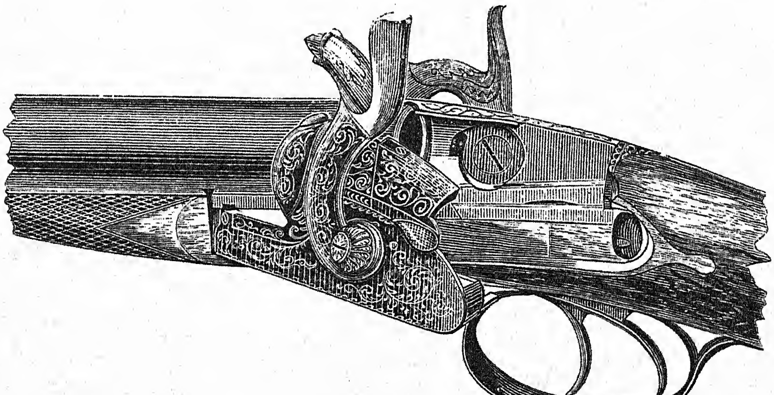


Fig. 273.—Mr. J. Walsh's Pin-fire Gun.

In the arrangement of the barrels we have also tried to effect an improvement. Some five years ago, we thought double guns would be more handy if the barrels were placed the one over the other instead of side by

side. This we very easily effected with our wedge-fast action, and illustrate the gun in Fig. 272.

The barrels, instead of dropping down on opening the gun, move in a lateral direction, as shown. The explosion is effected by studs on the tumblers striking exploding-pins.

Although only made as an experiment it proved almost as handy as a single gun, and the recoil being in a direct line with the stock, the gun had not the tendency to throw the charge to the left or right, as is usual with ordinary double guns.

Fig. 273 represents a pin-fire gun of peculiar construction. The locks are pivoted vertically, and open as it were on a hinge, to admit the cartridges. A reference to the engraving will make the principle appear more clear. The locks are secured in their places by a small lever turning a "button" on the inside of each lock-plate, and which engages in slots in the tang of the break-off.

CHOKE-BORING: A HISTORY AND DESCRIPTION.

THE principle of choke-boring appears to have originated with the early Spanish gunmakers, for upon referring to some old works on gunnery published about a century ago, we find plans given for improving the shooting of guns by various methods of boring. In "La Chasse au Fusil," M. de Marolles asserts that some of the gunmakers of his time maintained that, in order to throw the shot more closely, the calibre should be narrower in the middle than at either breech or muzzle; whilst others insisted that the calibre must contract gradually from breech to muzzle. Amongst the methods mentioned for obtaining this result, the one we consider really the original idea of the choke-bore principle is described by M. de Marolles as follows:—"An iron or wooden mandril, fitted to the calibre, is furnished at one end with small files, which are cut transversely only. This instrument, being introduced into the muzzle of the barrel, is turned round by means of a cross handle, and forms a number of superficial scratches in the metal, by which the defect of scattering the shot is remedied. One effect of this plan is that of destroying the smoothness of the barrels within, rendering them liable to foul, and causing them to lead sooner after the discharge."

From this we gather that the gunmakers in the days of flint and steel were persevering to improve the killing range of their guns, and in proof of the above we will make a few extracts from "Le Vieux Chasseur," published by Deyeux in 1835.

At page 28 occurs the following paragraph:—

"J'ai vu par un canon légèrement espingole à l'orifice, serre au centre et libre au tonnerre, tel que de bons canonniers pretendent qu'il est mieux de les établir. Je l'ai vu par un canon étranglé de deux balles à l'orifice, et par un canon parfaitement cylindrique." [I have seen these results produced by a barrel slightly opened at the muzzle, choked in the centre, and freed at the breech, such as some good gunsmiths pretend is best to make them. I have seen the same results by a barrel choked two sizes at the muzzle, and by a perfectly cylindrical gun.]

Further on, page 36, it states:—

"Le canon dont l'orifice est trop etranglé ne garnet presque au centre.' [The

barrel whose muzzle is too much choked seldom makes a good pattern in the centre of the target.]

From this it will appear that the old French gunmakers, Boutet, Brière, Lepage, Perin, &c., who were said to have made guns on the choke-bore principle, could not have thoroughly understood it, or they would have been able to have produced better results. We think, however, it is probable that the French makers obtained their knowledge from the English, as the following old advertisement proves that some modification of the choke-boring system was practised in England during the last century.

Advertisement in the *St. James's Chronicle or Evening Post,* from Tuesday, May 5th, to Thursday, May 7th, 1789:—

"TO GENTLEMEN SPORTSMEN.—Guns matchless for shooting to be sold, or twisted barrels bored on an improved plan that will always maintain their true velocity, and do not let the bird fly away after being shot, as they generally do with guns not properly bored. The shortest of them will shoot any common shot through a whole quire of paper at 90 yards with ease. This method of boring guns will enable every shooter to kill his bird, as they are sure of the mark at 90 yards. A Tryal of their performance, as above, may be seen at Mr. Mellor's, Greyhound Lane, near the Infirmary, Whitechapel, London, where he bores any sound barrel for two guineas, to Shoot in the same manner, and makes them much stronger than before; has also twisted double-barrel guns, famous for partridge shooting, and all double proved. Note.—No guns sent to strangers without the money, nor letters received unless the postage is paid."

Now, having quoted from the early writers on firearms, we gather two or three valuable facts. We learn that the gunmakers in the days of flint and steel were racking their brains for some improvements to make guns shoot a longer distance, and among the many plans the one mentioned by M. de Marolles appears to have been more correct in principle, viz., narrowing the bore at the muzzle, by raising ridges, like the cuts of a file, for a short distance down, which, after a few shots, would fill up with lead, and by that means concentrate the shot. Although this plan would only answer for a certain number of shots, and would not last long, through not being made properly, we believe this plan was nearer the correct principle of choke-boring than any of the many others which were practised in those early days of gunnery.

In an interesting work upon "American Wild-Fowl Shooting," by Mr.

J. W. Long, a long chapter is devoted to the history and origin of choke-boring. Respecting the merits of choke-boring this writer says :—

"Since the invention of percussion locks, no improvement in the construction of shot-guns, or fowling-pieces, as they were then called, has ever appeared so truly valuable to sportsmen as that peculiar formation of bore known as the 'choke,' by which the divergence of the pellets of a charge of shot in their flight is greatly modified and controlled. I need only mention the fact that by its use the effective range of any gun may be greatly increased, in many cases fully doubled, and its claim to pre-eminence is fully established; for who among sportsmen does not experience a greater pleasure and satisfaction upon the occasion of one *long*, clean, successful shot, than at the killing of a dozen close ones?"

This writer claims that choke-boring is without a reasonable doubt an American invention.

"I have most positive and reliable proof of its having been practised in this country, according to the most approved manner of the present day, over fifty years ago; the earliest person whom I have been able to trace a knowledge of it to being Jeremiah Smith, a gunsmith of Smithfield, Rhode Island, who discovered its merits in 1827.

"I have the evidence of several disinterested parties to the effect that Mr. Smith so bored guns at that time, and one Mr. N. Whitmore, of Mansfield, Mass., in his day a noted rifle maker, worked for Mr. Smith, learned this method of boring from him, and afterwards practised it while doing business for himself, as numbers can testify. The writer being dissatisfied with the shooting of his old muzzle-loading gun, after a season's duck-shooting, he, in conjunction with a friend (a Mr. F. Kimble), each agreed to obtain a new gun apiece, to be the closest shooting weapons to be obtained. Mr. Kimble ordered a muzzle-loader from a gunmaker of Peoria, whilst Mr. Long had his breech-loader built in Boston. When the guns were completed and notes compared, it was found the breech-loader beat the muzzle-loader considerably. This gun, which was the first choke-bore the writer possessed, he tried in July, 1870, and found it to average from 55 to 60 pellets of No. 4 in a 12-in. square target at 40 yards, the highest being 66 at 50 yards; 40 pellets of similar charge struck same size target.

"In the fall of that year I went west again, and with my friend Fred and a man named Doty, of Henry, Illinois, started on another duck-shooting expedition down the Illinois and Mississippi rivers to the sunk lands of south-eastern Missouri.

"I found it quite difficult at first to do good shooting with my gun, as did also Fred with the pigeon-gun, and for many days on the Illinois both guns were left untouched on the boat in which we travelled, Fred making use of his 'Secor,' and I using one of a pair that belonged to Doty. Sometimes Doty had use for both his guns, and begun to poke fun at me because I could not shoot my own, so one evening I persuaded him to try it for himself, and though a very much better shot than the average of duck shooters, he actually fired the gun ten times without killing a bird, crippled one Mallard, and returned to the boat. The chief cause of his numerous misses lay in the fact that the gun shot about 6 inches high at 40 yards, and he was not aware of it.

"The ducks were very plentiful on the same evening, and with his gun I killed seventy-five between half an hour before sundown and dark, hardly ever getting time to load both barrels, and had I had my own gun, with plenty of ammunition, and been able to shoot it right, could very likely have nearly doubled the number. From that time I resolved to learn to use my own gun, and after a short time 'got the range of it,' the chief difficulty at first being to remember to aim low.

"Fred changed to the single gun too, and before we got to New Madrid, Mo., our southern destination, we could kill close shots as well as with any gun, and long ones where the other guns were out of the sport entirely."

This writer gives as the first public notice of choke-boring the following circular, issued by Mr. J. L. Johnson, of Young America (now known as Monmouth, Illi.), who obtained his knowledge of choke-boring from the inspection of the guns before mentioned. The circular was issued in the summer of 1872 :—

"ATTENTION, SPORTSMEN !—Having discovered the principle by which guns can be made to shoot close, I wish to call the attention of the sporting community to the fact that I am now prepared to bore shot guns, and will guarantee them to put the whole charge in a 30-inch circle, or from 45 to 60 pellets, No. 4 shot, into a foot square at 40 yards, as from 12 to 20 is about the average shot for an ordinary gun, the range is increased from 20 to 30 yards. My price is 10 dollars, or 5 dollars per barrel. Satisfaction given or no charge.—J. L. JOHNSON."

We have before given a notice from an old paper in our possession which will prove that the above is not the first public announcement of choke-bores.

THE DIFFERENT METHODS OF BORING GUN-BARRELS.

Until the choke-bore plan was introduced, there were three ways of boring gun-barrels known to the trade. First, the straight, or cylinder bore ; the next plan was the cylinder bore, but enlarged at the breech for some ten inches up ; the third plan was what is known as the relief-bore; that is, being opened at both breech and muzzle, leaving the narrowest part of the bore about the middle, no part of the barrel being cylinder (see Fig. 274). No. 1 shows the interior of the barrels bored a perfect cylinder ; No. 3 shows a similar barrel enlarged at the breech ; No. 2 shows the barrel with both breech and muzzle enlarged. Another form is occasionally used, called a taper-bore, being tapered from breech to muzzle. This latter plan has no advantage over the former, as it causes excessive recoil, and is, therefore, not liked by sportsmen. The cylinder-bored guns, as a rule,

make but indifferent shooting, except in some instances, when they perform fairly well with certain charges. The barrels that are enlarged at the breech make better penetration, but the barrels that are opened at both ends give superior pattern and penetration. We have tested many guns by different first-class makers, and find but few cylinder bores. The relief-bore was adopted by the late William Greener with great success in muzzle-loaders many years ago, which brought his guns into such notoriety, and the best guns at the early London gun trials were bored upon the relief principle.

DESCRIPTION OF CHOKE-BORING.

The term choke-boring appears to have originated with the French, as in the writings of some old French authors choke-boring is mentioned, and called *etranglé* for want of a better name, and adopted by the English and Americans. To an English gunmaker the terms mean simply "barrels whereof the diameter of the bore at the muzzle is less than the bore at some point behind the muzzle, other than the chamber," while any gun-barrel constricted at the muzzle to the extent of 5000ths of an inch may be termed a modified choke. A full choke is constricted to the extent of 30 to 40,000ths of an inch, but the larger the bore the greater must be the constriction at the muzzle. The constriction of the bore, to be effective, must finish from ½ to 1 inch of the extremity of the barrel, this same constriction, if placed 3 or more inches from the muzzle, fails to throw the shots close together, but will give better penetration than a cylinder bored barrel. There are two distinct plans of choke-boring; the first, and which we believe to be the original method, is to bore the barrel cylinder for nearly the whole length, contracting it from 2½ to 3 inches from the muzzle, like No. 6.

The other plan is to enlarge the bore immediately behind the muzzle, and extending 3 or 4 inches towards the breech (see No. 4). A Mr. R. M. Faburn patented in America in 1872 an expanding bit or cutting tool for making this form of choking.

This principle of boring is known as Faburn's recess or jug choke. The patentee, after having prepared a good quantity of bits, and supplied himself with a gun bored upon his plan, commenced a tour of the Western

States selling his bits with the right of using to the various gun-dealers, and he succeeded so well that the system soon became generally known to about all the gun trade in the west.

These dealers quickly issued circulars extolling *their* new system of boring; and the very men who at the first rumour of choke-boring had derided the invention were loud in their praises, and placarded their own shops with wonderful announcements to sportsmen.

A modification of this principle is shown in No. 5. In this a kind of double choke is formed by enlarging the barrel from the first choke towards the breech in a more elongated form.

There is still another modification which consists of gradually enlarging the barrel from the breech to within 2 or 3 inches of the muzzle.

When the bore is constricted, as in No. 6, we have found by experience that for regularity and closeness of shooting there is no plan equal to that shown in No. 6, and it is the one we have used for all our guns that have competed in the public trials since 1874. We may say that Nos. 4 and 5 are now but very little used by English gunmakers.

The choke is formed either by boring sufficient metal out of the barrel behind the muzzles, or by compressing the muzzles until they are nearly two sizes smaller than the other part of the barrel. We look upon compression as a makeshift plan, and only resorted to by those makers who have not the necessary machinery for the proper boring of the barrels. A description of the method of choke-boring will be found under the head of barrel boring.

It is almost an impossibility to have a perfect cylinder to within a few inches of the muzzle, and the taper from breech to that point, by wear of boring bits and taps, may reach 3000ths of an inch. Yet it has always been our endeavour to have a perfect cylinder to the commencement of the choke-cone, and the nearer the barrel to that point is cylindrical, the better are the results procurable.

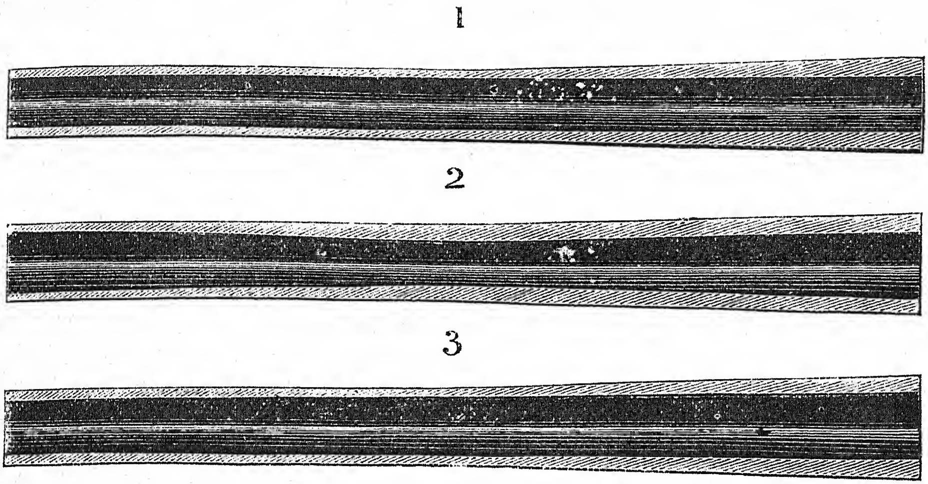


Fig. 274.—Various old styles of Boring.

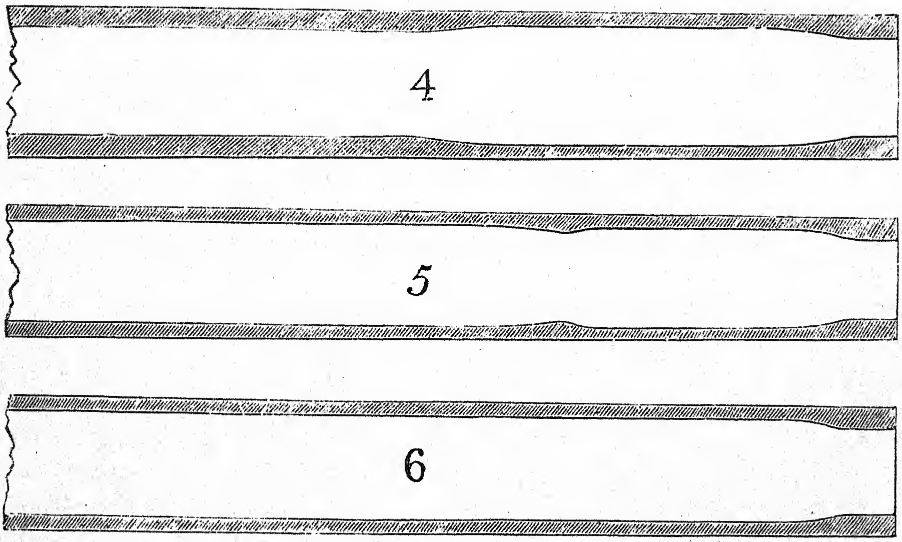


Fig. 275.—Various Choke-bores.

THE GUN TRIALS OF 1858-1859.

THE CIRCUMSTANCES WHICH LED TO THE LONDON *FIELD* GUN TRIALS.

THE Editor of the *Field* remarks as follows:—

"At the close of 1857, in undertaking the editorship of the department of the *Field* connected with shooting, I found its columns deluged with an angry correspondence on the comparative merits of the Breech-loader and Muzzle-loader. Statements and counter-statements were made, week after week, all of which could not possibly be true, since many of them were in direct opposition to each other; theories were propounded of the most visionary kind; yet, as generally happens, their inventors expected them to be received as conclusive of the opinion to support which they were brought forward. The battle had raged for several months, but after all this 'Bubble, bubble, toil and trouble,' no one was convinced, and the question was left exactly where it was when the correspondence commenced. But as numerous good sportsmen seemed really desirous of ascertaining with something like exactness the real merits of these guns, it was determined to give them a public trial, and the task of making the arrangements was undertaken by myself. The two Gun Trials of 1858 and 1859 we carried out with great care and trouble, and the real pretensions of Muzzle-loaders and Breech-loaders have been settled for the time to the satisfaction of all reasonable men."

The *Field* Gun Trial of 1859 was tried at targets made of double bag cap paper, 90 lbs. to the ream, all circular, 30 inches in diameter, with a centre 12 inches square, and nailed against a smooth surface of deal boards. This centre was composed of 40 thicknesses for the 40 yards, and 20 at 60 yards, the squares which were cut evenly at the edges, weighing 18 oz. and 9 oz. respectively, on the average, with a slight variation, which will always occur in brown paper. Powder—Laurence's No. 2, which was selected because it gave satisfaction last year. Shot No. 6 (290 pellets per

ounce), charges weighed in every instance. There were twenty-nine entries. We record the performance of the three best Breech-loaders and three best Muzzle-loaders.

Name of Maker.	Kind of Gun.	Charge of Powder.	Charge of Shot.	Pattern.		Penetration.		Weight.
				Right.	Left.	Right.	Left.	
Pape	Muzzle-loader (12-bore).	$2\frac{3}{4}$ drachms.	$1\frac{1}{4}$ oz.	158	118	28	33	6 lbs. 11 oz.
Prince & Green	Muzzle-loader (12-bore).	$2\frac{3}{4}$ drachms.	$1\frac{1}{4}$ oz.	148	98	28	22	6 lbs.
Pape	Muzzle-loader (12-bore).	$2\frac{3}{4}$ drachms.	$1\frac{1}{4}$ oz.	116	129	25	28	6 lbs. 8 oz.
Egan	Breech-loader (12-bore).	3 drachms.	$1\frac{1}{4}$ oz.	144	90	28	30	7 lbs. 8 oz.
Prince & Green	Breech-loader (12-bore).	3 drachms.	$1\frac{1}{4}$ oz.	103	93	24	31	7 lbs. 2 oz.
Pape	Breech-loader (12-bore).	3 drachms.	$1\frac{1}{4}$ oz.	132	93	26	33	7 lbs.
Joe Manton ...	Muzzle-loader (16-bore).	$2\frac{1}{4}$ drachms.	1 oz.	122	86	27	28	6 lbs. 12 oz.

Remarks.—The best Muzzle-loading Gun in this trial made a pattern of sixty-three with the right, and sixty with the left barrel, at 60 yards, and penetrated twenty sheets with five pellets with the right, and twenty sheets with two pellets with the left barrel at the same distance.

It will be seen that the performance of the Manton above recorded was nothing extraordinary, although it was said the barrels were in first-rate condition.

The great contest has been as between Muzzle and Breech-loaders, and it will be seen that in each class the old-fashioned gun has carried the day, though very closely pressed by its rival. Having thus gone through the results, we wish to point out the great improvements which have been made in the regularity of the shooting of each barrel since these first trials; one barrel, it will be perceived, made a pattern of 144, and with the other of only 90. In comparing this with the Cylinder guns in the great trial of 1875, it must be borne in mind that the charges of shot contained in $1\frac{1}{4}$ oz. were about 370 pellets, against 305 in the $1\frac{1}{8}$ oz.

used at the 1875 trial: so considerable improvements have been made since this 1859 trial.

The exertions of the Editor of the *Field* have been rewarded: they have been the means of further stimulating the gunmakers to give the sportsmen the finest shooting guns that could be produced.

FIELD TRIALS OF 1866.

SHOOTING OF THREE BEST GUNS AT 1866 GUN TRIALS.

In the Gun Trial of 1866 there were thirty-two guns in the 12-bore class. We record the performance of the three best guns for comparison with those of the later trials.

The *Field* Gun Trial of 1866 took place at the "Lillie Arms," Old Brompton, on the 22nd and 23rd of May, 1866. All the shots were taken with the foremost foot of the shooter 40 yards from the target, which was a circular plate of iron, 30 inches in diameter, having a square of paper suspended in the middle of its face, and close to it. This square was composed of forty thicknesses of double-imperial brown paper, 140 lbs. per ream, procured from Messrs. Pettitt, of Frith Street, Soho, by whom it was cut and tied up at each corner, the size being 10½ inches by 9½ inches—in round numbers, 10 inches square. In counting the pattern the hits on the iron were added to those on the paper, and in counting the penetration the number of sheets broken by any one shot were scored. The shot used was Walker, Parker, and Co.'s No. 6, London size, 280 pellets per ounce Powder—Curtiss and Harvey's No. 3, 5 or 6, at the discretion of the shooter, who was allowed any weight he pleased. It is worthy of remark that the eight guns highest on the list used No. 5 or 6, and the seven lowest No. 3—a fact telling strongly in favour of coarse powder.

In comparing these results with later trials, it must be remembered that smaller shot was used at this trial, viz., 280 instead of 270 to the oz.; this will make about twelve more pellets to the charge of 1⅛ oz. used, which would equal an average increase of pattern of five shots; this would make the best gun average about 122 instead of 127·1. In class 2, for 16-bores, the best

gun made an average pattern of 109·4, an average penetration of 22·5; an ounce of shot only was used.

The three lowest scores made by 12-bores were 69·4, 62·1, 75·5.

At this trial an 8-bore, 36 inches, 14½ lbs., double gun was also shot; it made the extraordinary low average pattern of 108·2 with 6 drs. of No. 3 powder and 1½ oz. of shot; out of the thirty-two 12-bores shot at the trial, 19 failed to score an average pattern of 100. These figures go to prove what poor shooting guns were made up to 1866, except by the very best makers.

Now, in 1880, guns can be obtained at the low price of 10 guineas that will far surpass in shooting the best gun shot at this trial. Cylinder barrels may now average 130, and chokes 200 or more.

Soft shot was used at this trial, and choke-boring was not known to English gunmakers.

Maker, Description and Weight of Gun.		Pattern (Six shots from each barrel.)									Penetration (Six shots from each barrel.)								Total Figure of Merit.
		1	2	3	4	5	6	Average of six shots.	Mean of two barrels.		1	2	3	4	5	6	Average of six shots.	Mean of two barrels.	
Pape, Lefaucheux Breech-loader, with pin cartridge; 7¼ lb.	Right...	140	146	130	132	135	104	131·1	127·1	Right...	23	27	27	26	31	27	26·5	25·4	305·4
	Left ...	158	144	47	106	159	126	123·2		Left ...	24	25	20	23	27	27	24·2		
Pape, Lefaucheux Breech-loader, with pin cartridge; 7 lb. 1 oz.	Right...	134	94	138	165	110	163	134	125·3	Right...	24	23	23	26	22	26	24	24	299
	Left ...	52	156	129	157	73	135	117		Left ...	20	32	23	27	20	22	24		
W.W.Greener, His Patent Wedge-fast Breech-loader, with pin cartridge, 7¼ lb.	Right...	114	124	115	110	158	125	124·2	121·4	Right...	26	19	31	18	26	28	24·4	25·3	294·2
	Left ...	130	80	127	137	118	122	119		Left ...	23	30	26	27	26	26	26·2		

In the first two guns 3 drms. No. 6, and in the other 3 drms. No. 5 powder was used.

GUN TRIALS OF 1875, 1876, AND 1877.

CHOKE-BORING.

WHAT LED TO THE GREAT LONDON GUN TRIALS OF 1875.

IN the spring of 1874 we first made experiments in Choke-boring, and were so far successful that the Editor of the *Field* gave a notice of our Treble-Wedge-Fast Gun and its performance. We extract the following, which appeared Dec. 5th, 1874, and which is interesting as the first public notice of what a Choke-bore Gun could accomplish :—

"We have not ourselves tested these guns, but Mr. W. W. Greener is now prepared to execute orders for 12-bores warranted to average 210 pellets of No. 6 shot in a 30-in. circle, with three drachms of powder, the weight of the gun being $7\frac{1}{4}$ lb. With larger bores and heavier charges, he states that an average pattern of 240 will be gained. As we have always found Mr. W. W. Greener's statements of what his guns would do borne out by our experience, we are fully prepared to accept those now made."

This was so far in advance of any performance hitherto known, that neither gunmakers nor sportsmen would credit the statement. The week following appeared a letter from E. O. Partridge, Esq., corroborating the former statement and extolling the new system, his own Purdey gun being beaten by an average of over 60 pellets.

The readers of the *Field* still refused to credit such extraordinary shooting, and this led to a Special Commissioner from the *Field* Office being sent down to witness and verify the shooting of our guns. The patterns obtained averaged 220, and the result was highly satisfactory. Shortly afterwards several gunmakers claimed to be in possession of the same method of boring as we had adopted, and after a lengthy discussion in the *Field*, the proprietors of that paper decided to carry out a gun trial and thoroughly test the merits of the new system advocated by us.

THE *FIELD* GUN TRIAL OF 1875.

In this trial the guns were divided into four classes.

Class 1.—For 8 and 10-bores any weight or kind of boring, and used with any charge.

Class 2.—For guns of any kind not exceeding 12-bore or over $7\frac{1}{4}$ lbs. weight.

Class 3.—For 12 gauges and under of English boring, not over $7\frac{1}{4}$ lbs.

Class 4.—For 20-bores and under of any kind of boring. No gun over 6 lbs.

The charge of shot for 12-bores was $1\frac{1}{8}$ oz. No. 6, for 20-bores $\frac{3}{4}$ to 1 oz. of No. 6.

The following remarks are from the conditions of the trial:—

"The entries to be confined to gunmakers, and in each class no gunmaker to enter more than three guns. The Editor of the *Field* to be the manager, and his decision on all points to be final, subject only to the committee who are to be chosen by the proprietors of the *Field*. No entrance-fee to be charged for the guns.

"The competition to be at the ground of the All England Croquet Club, near the Wimbledon Station, commencing at ten o'clock on Monday, April 26, and continuing daily from the same hour till completed. The guns to be shot in the order of their entry, from the usual gunmaker's adjustable rest, by the competitor or his representative.

"The guns in each class to be tried twice—the first round at 40 yards, with a Pettitt pad of 45 sheets in the centre of a 30-in. circle, six shots each barrel. The greatest number of pellets within the circle to be added to six times the number of sheets penetrated by three pellets, in order to give the figure of merit; the counting to be done in the presence of the competitors at the conclusion of each set of 12 shots. If this round in any one class is completed in one day, then the guns giving the six highest figures to be selected for the second round; but if not, then a proportionate number, making up together the required six, to be taken from each day's score.

"For the second round, these six guns are to be shot at a target 4 ft. square, having a Pettitt pad in the centre for penetration, and a selected

group included in a 30-in. circle, to be drawn from a centre fixed on by the competitor, or his representative, for pattern. First time, 6 shots from each barrel, at 40 yards; second time, ditto, ditto, at 60 yards. The figure of merit to be computed in the same way, and the gun making the highest score from both distances combined to be adjudged the winner of the cup or prize.

"The distances to be measured from the butt of the gun.

"The shot to be either Lane and Nesham's or the Newcastle Chilled Shot, No. 6, about 270 pellets per oz."

In Class 1 we came out first with our 8-bore, which made an average pattern of 321, with $2\frac{1}{2}$ oz. No. 6 Chilled Shot; the penetration was also far in advance of any gun shot in this class.

The manager remarked upon the performance of this gun: "With regard to the performances of the guns in Class 1, Mr. Greener's 8-bore certainly did wonders at 40 yards, both in pattern and penetration; but beyond this distance the enormous charge of shot ($2\frac{1}{2}$ oz.) did not seem to be of much service, and it evidently requires a larger size than No. 6 to do justice to these 'cannons,' which, of course, are only to be treated as duck guns. The 'choke' is with them an immense advantage, and will no doubt be largely used for the above purpose."

There were only 9 guns competed, four makers having withdrawn their guns. We were first with the only 8-bore we entered, and first and second with our two 10-bores, which obtained a higher figure of merit than two of the 8-bores shot against them. One of the 8-bores, by a celebrated London gun-maker, made an average pattern of 163·9 only, which was far behind our winning 12-bore.

In the second round, with a selected group, our 8-bore made an average pattern of 358·9, and our 10-bore 241·2 with the same charges as used in the first round.

Class 2.

In this class there were sixty-eight guns and thirty-three competitors. We gained the first prize (a Silver Cup, valued 40 guineas), our gun making an average pattern of 214, and penetration of 206·5. The second gun by a provincial maker made an average pattern of 182·2, and penetration of 200·5. The two worst choke-bores in this class made

average patterns of 109·6 and 93, which were much worse than many of the cylinders. The remaining sixty-four guns averaged every pattern between these extremes.

We here give a summary of the shooting of the six best guns in this class.

Silver Cup presented by the Proprietors of the *Field*, and won by W. W. Greener.

SHOOTING OF SIX BEST GUNS.

GUN.	AVERAGE PATTERN.	AVERAGE PENETRATION.
No. 1	214·5	206·5
„ 2	182·2	200·5
„ 3	179·5	191
„ 4	175·5	196
„ 5	176·5	188
„ 6	171·8	189

The recoil was not taken at this trial.

This was extraordinary close shooting; nothing equal to it having been attained in the gun trials of New York, 1873, or Chicago, 1874; the best 12-bore at the New York trials making an average pattern of 150·5 only, with paper shells. At the Chicago trials, the highest average pattern with a 12-bore was 166·5. It is impossible to draw comparisons in penetration, as at the American trials a different system of scoring was adopted. There is, however, no reliable evidence to show that previous to 1874 the Americans were able to bore guns to shoot as close as the best of those shot at the 1875 trials, and it is our opinion that they had not worked out the Choke-bore system to its utmost capability; and this opinion is supported by the fact that at the Chicago trial of 1879 the best 12-bore choke registered an average pattern of 170 pellets only, with 3 drs. and $1\frac{1}{8}$ oz., the ounce containing about twenty pellets more than there are in the English No. 6.

Class 3—For Guns of English Boring or Cylinders.

This was won by a slightly modified Choke-bore, the muzzle being contracted nearly 5000th of an inch. This gun made an average pattern

of 148·5, and penetration of 165. The second gun, a true cylinder, made an average pattern of 129 only, and penetration of 168·5.

The lowest average pattern was 82.

In comparing the results with the trial of 1866, a little improvement in the penetration is noticeable, but the average patterns were hardly equal to those obtained in 1866, but this is accounted for by the difference in the shot, a larger number being allowed at the former trial, where the pellets were also slightly smaller and consequently more to the ounce, and the cartridges loaded by measure instead of by weight.

The shot used in the 1875 trials was considerably harder than that used in 1866.

Class 4.

Seven guns only competed in this class, and all were Choked. These little guns beat all the 12-bore cylinders at 40 yards both in pattern and penetration.

At the longer range of 60 yards the reduced charges told against these light guns, and they were well beaten by the cylinder twelves, both for pattern and penetration. Our little 20-bore, weighing only 5½ lbs., came out the winner by several points. We used a charge of 2⅛ drs. and 1 oz. of No. 6 chilled shot. The average pattern at 40 yards was 145·3, penetration 141; at 60 yards average pattern 50·1, penetration 54. The second gun made an average pattern at 40 yards of 135·5, penetration 129, and the lowest average pattern recorded at this distance was 71. All except ourselves used a charge of from 2⅛ to 2½ drs., and some of the guns were as heavy as 6 lbs.

The only 16-bore shot at this trial was in Class 2. It made an average pattern of 129·3 and penetration of 166·5 at 40 yards (not shot at 60 yards). It weighed 6 lbs. 4 oz., and was shot with 2½ drs. and 1⅛ oz. chilled shot.

THE WEAR AND TEAR TRIAL OF 1875.

Some doubts having been entertained as to the lasting power of the Choke-bore, it was determined by the *Field* Trial Committee to institute a Wear and Tear Trial; the conditions may be summed up as follows:

three guns to be chosen to go through a series of firing for six weeks, one gun to be supplied by ourselves and two others by competitors in the 1875 trial. Two hundred shots to be fired into a pit, gun to be wiped out, and 200 more shots fired the next morning; the gun again to be wiped out, 12 rounds fired at a target, after each 200 shots. Gun to be then cleaned and laid aside until the following week. The firing to be repeated each week until at least 2,500 shots should have been fired by each gun. The guns to be kept under lock and key. The pit shots to be made at the rate of 60 shots per hour.

Our gun came out first in both pattern and penetration, the average of 244 rounds being—pattern 185, penetration 151·5, figure of merit, 336·5; the second competitor averaged a pattern 182·3, penetration 135, figure of merit 318. The gun shot by us in this trial was not the same gun that won the 40-guinea cup in the previous trial, and the paper pads used were made of considerably thicker paper than those used in the former trial, hence a lower figure of merit was obtained.

The result of the trial proved highly satisfactory to the Choke-bores, it being clearly demonstrated that there was no falling-off whatever in the quality of the shooting.

A Wear and Tear Trial, in which upwards of 80,000 rounds were fired without deterioration, has already been given.

THE GUN TRIALS OF 1876 AND 1877 AT PIGEONS.

The 1876 Trial was shot off at the Gun Club, Notting Hill, on July 21, 1876. The Smooth-bores scored 59 at 27 yards rise, and 47 at 33 yards rise; the Choke-bores scored 57 at 27 yards and 40 at 33 yards. In this match concentrators were used in the cylindrical barrels; this made them about equal to the modified Chokes. Besides this, the majority of the best shots were upon the smooth-bore side, being as 7 to 4; had the sides been equal it is probable that the Choke-bores would have been victorious. The following year a return match was made, the sides were more equal, and concentrators were excluded. There were nine guns on each side, at five birds each at 30 yards, and five each at 40 yards, for a sweepstake and a silver cup, presented by Mr. J. Purdey.

The Fifty Guinea Cup presented by Mr. J. Purdey.

The Choke-bores won the first day by 4 birds The best score was made by Mr. H. C. Pennell, who killed 5 birds at 30 and 3 birds at 40 yards. It was noticed that Mr. Pennell with his Greener gun brought his birds down in splendid style at from 60 to 70 yards distance ; he also used but $3\frac{1}{4}$ drs. powder, whilst $3\frac{1}{2}$ drs. was used by some of the other competitors. The prize for this match was a 50-guinea cup, given by Mr. Purdey. We had only one gun in this match, used by Mr. Pennell, against fourteen by the first London makers and three by provincial makers. The next day a sweepstake was shot for, the same sides competing.

The Choke-bores were first by 14 birds. This trial fully proved that Choke-bores were the best weapons for this shooting, and they have since come to be generally used at all the gun clubs.

THE "FIELD" GUN TRIAL OF EXPLOSIVES, 1878.

The object of this trial was to compare the relative merits of the black and Schultze powders, or, as it appears to us, to ascertain if the Schultze powder could be relied upon for sporting purposes. The trial was of the most exhaustive nature, over 2,000 rounds being recorded. There were six Chokes (of which three were supplied by us), and six cylinders (one supplied by us). The result of the trial showed that the most uniform and regular patterns could be obtained from the black powder, whereas the Schultze had the advantage of penetration. This is the first trial in which the recoil was registered since 1859. The guns were fired from a machine rest designed by the editor of the *Field* (see Fig. 275); and by means of a Salter's spring balance the recoil of each shot was accurately recorded. The penetration was obtained from paper pads (40 sheets), $9\frac{1}{2}$ inches by $10\frac{1}{2}$, with a black square of 4 inches marked on its centre. The figure of merit was made up as follows :—

Average penetration of three shots, multiplied by six, as in previous trials, say		180
Deduct difference between lowest pattern made and average pattern, say	45·3	
Ditto average recoil in pounds above 50	35·5	84·3
Ditto between highest and lowest recoil	3·5	
		95·7

SUMMARY OF AVERAGES.

Choke-bores with Black Powder.

Six guns, 450 shots, mean average pattern	192·53
" " " penetration	140·00
" " difference of pattern	71·59
" " recoil above 50 ...	37·29
" " differences recoil	5·03
" " figure of merit	26·09

Choke-bores with the Schultze Wood Powder.

Six guns, 450 shots, mean average pattern	188·25
" " " penetration	159.08
" " difference of pattern	107·66
" " average recoil above 50	36·40
" " average difference in recoil... ...	7·25
" " average figure of merit	19·73

Our three choke-bores came out first, second, and third in the trial. The mean average of three with the black powder was—

Mean average pattern	192·60
Mean average penetration	146·22
Mean average merit	48·86

and with the Schultze wood powder—

Mean average pattern	191·90
Mean average penetration	160·45
Mean average figure of merit	41·90

The summary of this trial proved that there was very little difference in the merits of the three black powders tested—namely, that of the well-

known makers, Messrs. Curtiss and Harvey, Messrs. Hall, and Messrs. Pigou, Wilks and Laurence—the total variation not being beyond the range of chance, whilst the individual scores were still more up and down. The Schultze powder, however, came out much better than was anticipated, the penetration being superior to the black, and very good patterns were also made with it; but the difference between the lowest shot and average pattern was so great as to lower its figure of merit below those obtained by the black powder. As a natural result of this trial, the confidence of the sporting public was placed in the Schultze powder, and many who had previously been afraid of using it adopted it readily; but, unfortunately, towards the end of the season, a fresh batch of this powder was issued which proved much stronger than that used at the trial, and caused several guns to burst, and many breech-actions were severely strained by its use. We understand that this powder requires, after being carefully manufactured, to stand some time, to become properly toned down before using it, or uniform results cannot be obtained. That used in the year 1879 was exceedingly good—nearly equal to the black for uniform shooting, and, we consider, far superior to that used at these trials, or indeed to any previous issue.

The highest individual score was made with the black powder fired from a full choke-bore gun of our make. It made the most wonderful shooting on record, the average pattern of twenty-five shots being 220·8; average penetration, 154·32; difference in pattern, 24·08 only; average recoil above 50 lbs., 36·88; difference in recoil, 5·00; figure of merit, 88·36, being the highest ever obtained under the same conditions. The greatest difference in pattern occurred in shooting black powder from the gun of a provincial maker, the patterns varying from 42 to 216. The figure of merit obtained by this gun was 43·06 *minus*, being 131·42 points below the winning gun. This, however, was not quite the lowest figure obtained by this maker.

Some of the cylinder guns fired in this trial showed a decided improvement upon the scores made by cylinders at the 1875 trial, the highest average pattern being 139·40, and the average penetration of this gun was 137·76. In recoil the Schultze powder showed a decided advantage, the average recoil of black powder in the chokes being 87·29, in the cylinders 87·23; the average of the Schultze being, in the chokes 86·40,

and in the cylinders 83·29: but there is more variation in recoil with the Schultze than with the black, the average difference with the Schultze powder being 7·25 against 5·3 with the black, with the chokes. And in cylinders the difference was even more marked.

Many sportsmen hold the opinion that the recoil of choke-bores is very much greater than that of the cylinder bores. This trial proves, however, that there is only a very slight difference between them—viz., ·09 of a lb., taking the average of 900 shots with the black powder.

FURTHER EXPERIMENTS WITH THE GUNS AT DIFFERENT RANGES.

It having been suggested by an old subscriber of the *Field* to take the pattern of each gun on a 4-inch square centre, each pad was marked with a 4-inch square bull's-eye. Our best gun scored in this centre—

At 40 yards, with black powder:—Left barrel, 9, 9, 10, 12, 13, 9, 9, 11, 7, 8, 10, 13, 16; Right barrel, 9, 21, 8, 10, 7, 7, 11, 7, 5, 7, 12, 7.

At 50 yards the same gun averaged, with No. 6 shot:—Left barrel, 5: Right barrel, 5·40. With No. 5 shot the averages were:—Left, 3·75. Right, 3·76.

At 60 yards it obtained an average of 2·32 with the left and 2·83 with the right—3¼ drams and 1¼ oz. of No. 6 shot. With No. 5 shot and 3⅛ drams powder the averages were:—Left, 2·32; Right, 2·32.

The best cylinder averaged 5·5 at 40 yards. It failed on one occasion, with Schultze powder, to throw even a single pellet into a 4-inch centre, and in several cases only one shot; at 50 yards it averaged 2·18. As the cylinder failed in several instances with this centre at 50 yards, it was considered advisable to try our Choke only at 60 yards, it being clear that the cylinders were useless at that distance. From these figures it is evident that at 60 yards, even with a Choke, a 4-inch square may occasionally escape; whilst with a cylinder such an escape is by no means uncommon, even at 40 yards, and at 50 it is common enough, and in 60 the rule rather than the exception.

The Choke-bore gun at 50 yards made an average pattern in a 30-inch circle of 153, with 3¼ drams of No. 4 powder and 1⅛ oz. No. 6 shot.

At 60 yards with 3¼ drams and 1¼ oz. No. 5 shot an average pattern of 88.

At same distance with 45 grs. of Schultze powder and $1\frac{1}{8}$ oz. of No. 6 shot, average pattern of 110.

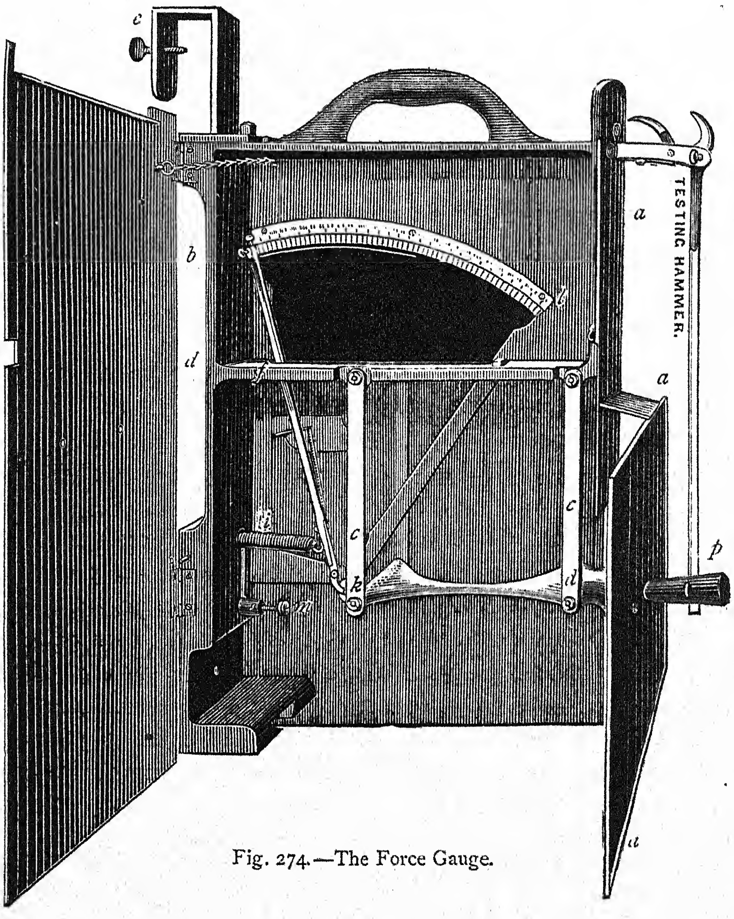


Fig. 274.—The Force Gauge.

THE LONDON "FIELD" TRIAL OF 1879.

The trial took place at Wimbledon, and commenced on Monday, the 28th April, and extended over six days. The trial was originated by the *Field* newspaper for the purpose of testing the relative merits of 12-, 16-,

and 20-bore. There were twelve entries in each class. The guns were fired from a machine-rest designed by the Editor of the *Field*, of which an illustration is given in Fig. 275. The penetration was registered by means of a force-gauge, also designed by the Editor of the *Field*; an illustration of this machine is shown in Fig. 274. It will be seen that the face-plate, *a a*, is a 10-in. steel target, from which the force of the pellets

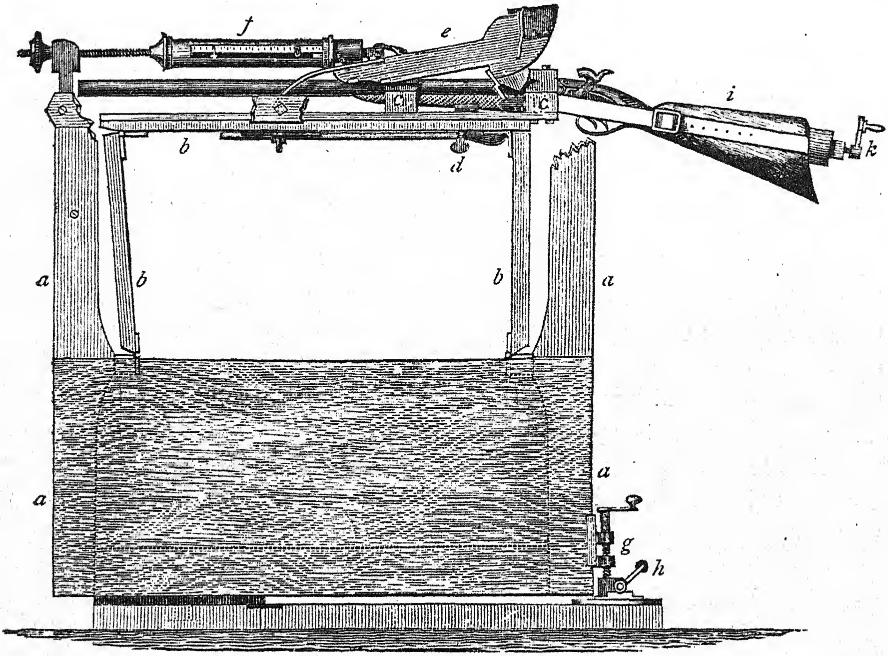


Fig. 275.—The "Field" Machine Gun Rest.

striking it is registered. It is fastened to the platform and swung from the frame of the machine, *d d*, by four parallel rods, *c c* (two on each side). Upon the target, *a a*, being struck by the shots, it is forced back on the short arm of the lever, *f*, the friction being minimised by the roller, *k*. The long arm, *g*, is shaped at the top to receive a vulcanite pointer, which bears upon the enamelled glass plate and traverses it from end to end; *l l*, is the scale; *i* and *j* are springs for registering the force of the blow, which is marked by the vulcanite pointer upon the enamelled glass plate

previously painted with lamp-black and oil; *p* is a hammer to which the machine is set by regulating the strength of the spring, *j*, which is effected by the thumbscrew *m*; *e* is a screw for attaching to ordinary target.

Machine-rest represented in Fig. 275.—The frame, *a a a a*, is of ash and mahogany cut away to show. The frame being made of ash yields to the force of the explosion, and imitates the human shoulder far better than any iron or perfectly rigid machine rest. *b b b* is a platform supported on two hinged parallel uprights; the gun is affixed to this platform or slide by the blocks, *c c*, which are cut out to receive the barrels, which are further embraced by a padded clip adjusted by the thumbscrew; *e* is a double wedge dropping down to catch shoulder of *c* when gun recoils. The recoil is registered by an ordinary steam locomotive gauge, *f*, adjusted by a screw, and having a travelling indicator. In this trial the gauge was set at 80 lbs. In setting the machine a correct aim may be taken, as the rest is capable of being moved perpendicularly by the adjusting screw, *g*, and transversely by the screw, *h*. Of course a wheel-plate is necessary in the fore-part to admit of these movements. *i*, the stock of gun fixed ready for firing, and held firmly by the leather breeching, tightened by means of a screw-pad, *k*, on the principle of the surgical instrument known as the tourniquet, when once set the gun does not require any readjustment. The gun is discharged by a cord being brought to press against the triggers.

There were 25 rounds fired from each gun at 40 yards, and the two best guns in each day's performance were shot at 60 yards. The average pattern of each gun had to be declared before it was shot, and the figure of merit was made up as follows:—The penetration computed according to the force per pellet indicated on the force gauge. The pattern computed according to the average deviation of the 25 patterns from the declared pattern, which average deviation is to be deducted from the penetration. At 60 yards the deviation to be computed from the average pattern, the average recoil above 80 lbs. to be deducted, and also the difference in recoil.

The final figure of merit to be computed from the totals of the two figures made respectively at 40 and 60 yards.

RECORD OF PERFORMANCE OF THE BEST GUNS AT THE LONDON GUN TRIALS OF 1879.

Twelve Bores.

The best gun made—	*40 yards.*		*60 yards.*	
Average force per pellet...		231·20		104·40
(Average pattern, 204·20)	...	...	(97·52)	
Average of the deviation of pattern from declared pattern	21·32		10·88	
Average recoil above 80 lbs.	31·24	58·56	27·92	42·80
Difference between highest and lowest recoils	6·00		4·00	
Figure of Merit ...		172·64		61·60

Final figure of merit ... ... 234·24.

The second best 12-bore gun made—	*40 yards.*		*60 yards.*	
Average force per pellet ...		238·72		109·20
(Average pattern, 209·60)	...	...	(98·72)	
Average of the deviation of pattern from declared pattern	26·64		14·76	
Average recoil above 80 lbs.	31·64	67·28	29·64	49·20
Difference between highest and lowest recoils	9·00		5·00	
Figure of merit ...		171·44		59·80

Final figure of merit ... . 231·24.

Sixteen Bores.

The best gun made—	*40 yards.*		*60 yards.*	
Average force per pellet ...		224·44		111·24
(Average pattern, 170·36)	...	...	(80·80)	
Average of the deviation of pattern from declared pattern	15·36		10·28	
Average recoil above 80 lbs.	19·24	39·60	15·28	29·56
Difference between highest and lowest recoils	5·00		4·00	
Figure of merit ...		184·84		81·68

Final figure of merit ... ... 266·52.

The second best gun made—	*40 yards.*		*60 yards.*	
Average force per pellet ..		217·76		96·88
(Average pattern, 166·16)	...	...	(70·28)	
Average of the deviation of pattern from declared pattern	15·92		13·72	
Average recoil above 80 lbs.	26·72	46·44	22·84	40·56
Difference between highest and lowest recoils	4·00		4·00	
Figure of merit ...		171·12		56·32

Final figure of merit ... ... 227·44.

TWENTY BORES.

	40 *yards.*		60 *yards.*	
The best 20-bore made—				
Average force per pellet...		224·48		80·16
(Average pattern, 150·72)	...	...	(67·28)	
Average of the deviation of pattern from declared pattern	14·84		9·32	
Average recoil above 80 lbs.	15·32	37·16	14·24	31·56
Difference between highest and lowest recoils ...	7·00		8·00	
Figure of merit		187·32		48·60
Final figure of merit ... ... 235·92.				

	40 *yards.*		60 *yards.*	
The second best gun made—				
Average force per pellet		223·88		70·36
(Average pattern, 152·20)	...	...	(68·44)	
Average of the deviation of pattern from declared pattern	20·24		14·36	
Average recoil above 80 lbs.	21·60	50·84	21·00	43·36
Difference between highest and lowest recoils ...	9·00		8·00	
Figure of merit		173·04		27·00
Final figure of merit ... ... 200·04.				

TABLES OF THE PATTERNS MADE BY THE BEST GUNS IN THE LONDON GUN TRIALS OF 1859, 1866, 1875, 1878, 1879, AND THE AMERICAN GUN TRIALS OF 1873, 1874, 1879.

		drams. × oz. shot.	Chilled shot.	Pattern. Right. Left.
LONDON GUN TRIAL, 1859—				
Muzzle-loader	12-bore	$2\frac{3}{4} \times 1\frac{1}{4}$ No. 6	290 pellets to oz.	158 118
Breech-loader	12-bore	$3 \times 1\frac{1}{4}$ No. 6		144 90
LONDON GUN TRIAL, 1866—				
Breech-loader	12-bore	$3 \times 1\frac{1}{8}$ No. 6	280 pellets to oz.	131 123
Breech-loader	16-bore	$2\frac{1}{2} \times 1$ No. 5		100^3 118^4
LONDON GUN TRIAL, 1875—				Average.
*Breech-loader	12-bore	$3\frac{1}{4} \times 1\frac{1}{8}$ No. 6	270 pellets to oz.	214-5
*Breech-loader	10-bore	$4 \times 1\frac{1}{2}$ No. 6		241-°2
*Breech-loader	20-bore	$2\frac{1}{8} \times 1$ No. 6		145-°3
*Breech-loader	8-bore	$6 \times 2\frac{1}{2}$ No. 6		358-°9
LONDON GUN TRIAL OF EXPLOSIVES, 1878—				
Breech-loader	12-bore	$3\frac{1}{4} \times 1\frac{1}{8}$ No. 6		220-08

* These four guns were shot in the selected circle, and with chilled shot.

TABLES OF THE PATTERNS—*continued.*

		drams. × oz.	shot.	Chilled shot.	Pattern Right. Left.
LONDON GUN TRIAL, 1879—					
Breech-loader	12-bore	$3\frac{1}{4}$ × —	No. 6	270 pellets to oz.	223-12
Breech-loader	16-bore	$2\frac{3}{4}$ × —	No. 6		174-00
Breech-loader	20-bore	$2\frac{1}{4}$ × —	No. 6		174-00
NEW YORK GUN TRIAL, 1873—					
Breech-loader	12-bore	3 × $1\frac{1}{8}$	No. 6	Shot with paper shell	150-$\frac{1}{2}$
Breech-loader	12-bore	$3\frac{1}{2}$ × $1\frac{1}{8}$	No. 6	Shot with metal shell	211-$\frac{1}{2}$
Breech-loader	10-bore	$4\frac{1}{2}$ × $1\frac{1}{4}$	No. 6	Shot with paper shell	211
CHICAGO GUN TRIAL, 1874—					
Breech-loader	12-bore	4 × 1	No. 7	309 pellets to oz.	180-°4
Breech-loader	10-bore	$4\frac{1}{2}$ × 1	No. 7		191-$\frac{1}{8}$
CHICAGO GUN TRIAL, 1879—					
Breech-loader	12-bore	$3\frac{1}{2}$ × $1\frac{1}{8}$	—	291 pellets to oz.	170
Breech-loader	10-bore	4 × $1\frac{1}{4}$	—		200
Breech-loader	16-bore	$2\frac{1}{2}$ × 1	—		163
Breech-loader	20-bore	$2\frac{1}{2}$ × 1	—		138

THE CHICAGO "FIELD" GUN TRIAL OF 1879.

The trial commenced Oct. 20, and continued for five days; as compared with the great London *Field* Trials in many instances the conditions were widely different, and the conclusions arrived at were also very different. In the first place, all the guns but one were supplied by the same maker, viz., 10, 12, 16, and 20-gauge breech-loaders; in addition one 6-gauge muzzle-loader was lent for the occasion, for the purpose of comparison. The shot used was Tatham's No. 7 (291 pellets to the ounce). The charges, both of powder and shot, were measured not weighed. A variety of charges were also used in the same guns. The method of testing the penetration was also different; instead of paper pads of forty sheets tied at each corner, the following contrivance was used:—A *rack* slotted at intervals of $\frac{3}{4}$ of an inch; in the said slots were placed sheets of straw-board of uniform texture and thickness; at each discharge the number of sheets perforated by any one pellet was noted, and this constituted the record of force for that particular shot.

The following tables record the performances with No. 7 shot:—

AVERAGES WITH DIFFERENT CHARGES OF POWDER.

Distance, 40 yards; 6 shots from each barrel.

Charge.	Pattern.		Force.		Recoil.	
	R.B.	L.B.	R.B.	L.B.	R.B.	L.B.
No 7 Shot, 2 drs. 1 oz., 20 gauge	119	128	10⅔	11⅓	76⅓	77½
2½ drs. 1 oz.	106	138	12⅓	13⅓	80⅔	80⅚
2¾ drs. 1 oz.	113	120	13⅔	13½	81⅚	82⅓
No. 7C* shot, 4 drs. 1¼ oz., 10 gauge	156	200	14½	15	93⅚	94⅔
4½ drs. 1¼ oz.	146	170	15	15½	97⅚	99⅓
5 drs. 1¼ oz.	157	191	16	16⅓	104½	103
No. 7 Shot, 3 drs. 1⅛ oz., 12 gauge	126	170	13⅓	13⅔	87⅓	86⅔
3½ drs. 1⅛ oz.	147	170	14½	14½	92	90⅔
4 drs. 1⅛ oz.	134	170	15½	16	96⅙	94½
2½ drs. 1 oz. No. 7 Shot, 16 gauge	119	163	13	13⅙	82½	84⅙
3 drs. 1 oz.	120	149	13⅚	14⅙	85⅚	80
3½ drs. 1 oz.	118	146	15	14⅔	89⅙	89

The 20-gauge gun with 2½ drams and 1 oz. (Tatham Bros.' No. 3 shot), 106 pellets to the oz. at 40 yards, made a pattern of 42 Right, 48 Left ; penetration, Right, 27¼ ; Left, 26¾.

The 16-gauge gun with 3 drams and 1 oz. (No. 3 shot), pattern of 56 Right, 59 Left : penetration, Right, 29 ; Left, 28½.

The 12-guage, 3¼ drams and 1¼ oz., 57 Right, Left, 85 ; penetration, Right, 28½ ; Left, 27½.

The 10-gauge, 4 drams and 1¼ oz., 68 Right, 73 Left ; penetration, Right, 30¾ : Left, 31.

The 6-gauge muzzle-loader, 5 drams and 1¾ oz. (B shot), made a pattern of 93 ; penetration, 40⅓.

60 *Yards Test.*

The 20-gauge gun, 2½ drams and 1 oz. (No. 3 shot), pattern, 16 Right, 20 Left, at 60 yards ; penetration, Right 18 ; Left, 20.

The 16-gauge gun, 3 drams and 1⅛ oz. (No. 3 shot), pattern, 25 Right, 28 Left, at 60 yards ; penetration, Right, 21 ; Left, 20¼.

The 12-gauge gun, 3½ drams and 1¼ oz. (No. 3 shot), pattern, 28 Right, 29 Left, at 60 yards ; penetration, Right, 17¾ ; Left, 20¼.

The 10-gauge gun, 4½ drams and 1½ oz. (No. 3 shot), pattern, 30 Right, 28 Left, at 60 yards ; penetration, Right, 19⅓ ; Left, 19¼.

The 6-gauge muzzle-loader (No. 3 shot), 6 drams and 1¾ oz., pattern, 69, at 60 yards ; penetration, Right, 22 5-6.

80 *Yards Test.*

The performances of the small gauge guns are not worth recording at this long range.

The 10-gauge gun with 4½ drams and 1⅝ oz. (No. 3 shot), pattern, 13 Right, 20 Left ; penetration, Right, 10½ ; Left, 11½.

The 6-gauge muzzle-loader, 6 drams and 1¾ oz. (No. 3 shot), pattern, 47 Right ; penetration, 14 5-6.

100 *Yards Test.*

The 6-gauge muzzle-loader, 5 drams and 1¾ oz. (No. 3) pattern, 13 ; penetration, 8½.

From the tables it will be noticed that the large sizes of shot gave very superior penetration to the smaller sizes.

The 6-gauge single muzzle-loader shot at this trial made an average pattern of (six shots) 227 pellets with a charge of 7 drams of powder and $1\frac{1}{2}$ oz. of No. 7 shot, containing about 440 in the charge. This is considered by the owner and others to be a wonderfully close shooter, but as compared with the best 10-bores in the London Gun Trial of 1875 it is far inferior. Our winning 10-bore guns in that trial gave an average of 241-2 with a charge of $1\frac{1}{2}$ oz. of No. 6, containing 405 pellets. We have since exceeded this last pattern with only $1\frac{1}{4}$ oz. of shot. Again, with a 12-bore pigeon gun and a charge of $1\frac{1}{4}$ oz. of No. 6 shot, we have succeeded in making the extraordinary pattern of 264·95.

It will be seen from the foregoing tables that the patterns made by the 10, 12, 16, and 20-gauges were not so uniform, nor were they so high, as those recorded at the London Gun Trials. With regard to the penetration, we consider the method adopted for its registration to be an excellent one, as whenever the charge of powder is increased, a corresponding increase is found in the record of the penetration. It also clearly demonstrates the great superiority of large shot over small shot for penetration, for during the trial several pigeons were shot at—distance, 40 yards. The gun used was 10-gauge, and the cartridges were loaded respectively with Nos. 7, 8, and 9 shot, as were employed in the tests of those sizes at the target. On dissection of the pigeons after being killed, we found that, although No. 8 shot striking in the body gave sufficient penetration to kill, No. 7 was the smallest size that could be driven through the bird, when the side with wings down was presented, and from these results it was agreed that any force strong enough to perforate from twelve to fourteen sheets of the pasteboard used in this test was sufficient to kill such game as pigeons or ducks when struck fairly.

It is also apparent that full chokes are absolutely necessary to kill game at 70 or 80 yards, and that the 10-bores are capable of shooting large-sized shot much closer, and with far greater effect, than the smaller bores, and in the 8-bore the capabilities may be still further developed, as larger charges may be used, and a denser pattern and larger killing circle obtained thereby.

NOTES ON GUN TRIALS.

FOR any gentleman or sportsman wishing to make a private trial of a gun, the best plan to follow is that used at the Chicago Gun Trial of 1879; and the readiest, most simple, and certain way of registering the force or penetration of the shot is by an apparatus similar to the one there used, and illustrated in Fig. 276. It consists of a wooden frame about 30 in. in length, 6 in. wide, and 7 in. deep, made of deal 1 in. thick, strengthened by an angle-iron facing. Sheets of strawboard are slid into the rack, and kept ¾ in. from each other by slips of wood nailed to the inner sides of the rack. The rack is placed upon a stand, so as to raise it about 4 ft. from the ground.

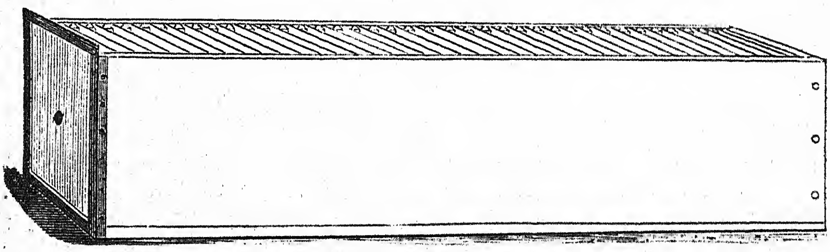


Fig. 276.—Rack for testing penetration.

The strawboard is of common quality, of an uniform texture, and not of a fibrous nature. Sheets cut suitable for the rack weigh 25 to the lb., and are not half so expensive as the Pettitt pad. Usually, 25 to 30 sheets are ample for testing the penetration of each shot, but the rack is constructed for 40 sheets. The same sheets may be used several times by turning or marking off with pencil, so that each shot can cost but little over a penny to test.

For gunmakers and gentlemen—especially those who are not used to finely-adjusted and fragile machines—this *simple*, *ready*, and *efficient* means of testing the striking force offers many advantages over the one

used at the London Trials of 1879. As the holes are punched clean through by the shot, no dispute can be raised, and there is no fine adjustment and reading of the machine.

We certainly allow that the atmosphere will to some extent cause the resisting power of the strawboard to vary, but still all charges fired on the same day may be compared (and to be strictly correct, all guns at any trial should be fired on the same day), so that the slight variation in the cardboard is but a bagatelle.

As a guide to experimentalists and sportsmen who may wish to show the capabilities of the various bores with different charges and modes of loading, we will now detail the results of our many private trials and experiments, and we think that in all cases they may be taken as a *fair standard* as to what may be expected from ordinary best shooting guns.

In making all trials, it is of the greatest importance that the *shot* be of a *standard size*, or all comparisons with other trials will be misleading.

Our trials have all been made with shot of the best make, and based upon the scale of sizes of the Newcastle Chilled Shot Company, given in the article on Shot, and taking for a basis the No. 6 shot of 270 pellets to the oz. Of late years almost all our experiments and trials have been made with best choke-bore guns, and it is these only that we shall detail, as true cylinder-bored guns are now so seldom made that any further records of their performance is entirely without interest; but we may mention here that in penetration they are inferior to choke-bores, but not to the same extent as they are inferior in pattern.

WHAT A GUN OUGHT TO BE AND DO.

Commencing with the smallest bore sought after by the ordinary sportsman, in our opinion a 20-bore should be from $5\frac{1}{2}$ lbs. to 6 lbs. weight, have 27- or 28-in. barrels, and shoot with comfort a charge of $2\frac{1}{4}$ drachms of powder and 1 oz. shot. If larger charges are required to be shot, ordinarily, it will be by far the best plan to have a 16-bore that will burn a larger charge without affecting the comfort of the shooter.

A 20-bore, full-choked, should make the following averages in a 30-in. circle, with best powder and three wads (one grease-proof, one felt, and one cardboard) between powder and shot:—

At 40 yards—

With $2\frac{1}{4}$ drachms and 1 oz. No. 8 shot, a pattern of 210, penetration of 13 sheets.

With $2\frac{1}{4}$ drachms and 1 oz. No. 6 shot, a pattern of 160, penetration of 18 sheets strawboard.

With $2\frac{1}{2}$ drachms and $\frac{7}{8}$ oz. No. 6 shot, a pattern of 150, penetration of 19 sheets.

With same charge, but No. 5 shot, a pattern of 100, penetration of 22 sheets.

With same charge, but No. 1 shot, a pattern of 65, penetration of 29 sheets.

At 60 yards—

With $2\frac{1}{4}$ drachms and 1 oz. No. 6 shot, a pattern of 60, penetration of 9 sheets.

With same charge, but No. 1 shot, a pattern of 35, penetration of 18 sheets.

A 16-bore, full-choke (much more useful size than the 20-bore), should weigh from 6 lbs. to $6\frac{1}{2}$ lbs., and fire a charge of $2\frac{1}{2}$ and 3 drachms respectively with ease to the shooter. The charge of shot is 1 oz., but sometimes, with No. 1 shot, $1\frac{1}{8}$ oz. may advantageously be substituted. The average shooting, with same wadding and conditions as given for 20-bore above, will be as under:—

At 40 yards—

With 2 drachms and 1 oz. No. 6 shot, a pattern of 165, penetration of 17 sheets.

With same charge, but No. 5 shot, a pattern of 140, penetration of 22 sheets.

With $2\frac{1}{2}$ drachms and 1 oz. No. 6 shot, a pattern of 165, penetration of 19 sheets.

With same charge, but No. 5 shot, a pattern of 140, penetration of 23 sheets.

With $2\frac{3}{4}$ drachms and 1 oz. No. 6 shot, a pattern of 160, penetration of 21 sheets.

With same charge, but No. 5 shot, a pattern of 140, penetration of 25 sheets.

With $2\frac{1}{2}$ drachms and 1 oz. No. 1 shot, a pattern of 70, penetration of 29 sheets.

At 60 yards—

With $2\frac{3}{4}$ drachms and 1 oz. No. 6 shot, a pattern of 75, penetration of 9 sheets.

With same charge, but No. 5 shot, a pattern of 65, penetration of 12 sheets.

With $2\frac{1}{2}$ drachms and 1 oz. No. 1 shot, a pattern of 40, penetration of 19 sheets.

A 12-bore, full-choke, may be made as light as $6\frac{1}{2}$ lbs., with 27- or 28-in. barrels, but from 6 lbs. 10 ozs. to $7\frac{1}{4}$ lbs. is the more general weight. Guns under 7 lbs. should have 28-in. barrels; over that they may be 30-in. We have made 12-bores with barrels but 24-in. long, and they have performed remarkably well with ordinary charges; also 12-bores, with longer barrels—32-, 34-, and 36-in.—but their performance has not surpassed that of 28- or 30-in. barrels with ordinary charges.

Twelve-bores under 7 lbs. will not shoot a heavier charge than $3\frac{1}{4}$ drachms and $1\frac{1}{8}$ oz. with comfort to the shooter. If over 7 lbs. and under $7\frac{1}{2}$ lbs., the charge may be $3\frac{1}{2}$ drachms and $1\frac{1}{4}$ oz.; over $7\frac{1}{2}$ lbs., guns are built for extra long cartridge-cases, or brass cases and special charges.

Loaded with grease-proof, thick felt, and cardboard wad between powder and shot, a full-choked 12-bore will make the following averages with best powder (patterns taken from 30-in. circle, penetration from straw-board sheets) :—

At 40 yards—

With $3\frac{1}{4}$ drachms and $1\frac{1}{8}$ oz. No. 8 shot, a pattern of 320, penetration of 15 sheets.

With 3 drachms and $1\frac{1}{8}$ oz. No. 6 shot, a pattern of 215, penetration of 20 sheets.

With $3\frac{1}{4}$ drachms and $1\frac{1}{8}$ oz. No. 6 shot, a pattern of 215, penetration of 21 sheets.

With $3\frac{1}{2}$ drachms and $1\frac{1}{8}$ oz. No. 6 shot, a pattern of 208, penetration of 22 sheets.

With $3\frac{1}{2}$ drachms and $1\frac{1}{4}$ oz. No. 6 shot, a pattern of 240, penetration of 21 sheets.

With 3 drachms and $1\frac{1}{8}$ oz. No. 5 shot, a pattern of 175, penetration of 22 sheets.

With $3\frac{1}{4}$ drachms and $1\frac{1}{4}$ oz. No. 5 shot, a pattern of 190, penetration of 23 sheets.

With $3\frac{1}{4}$ drachms and $1\frac{1}{4}$ oz. No. 4 shot, a pattern of 160, penetration of 24 sheets.

With $3\frac{1}{4}$ drachms and $1\frac{1}{4}$ oz. No. 3 shot, a pattern of 135, penetration of 25 sheets.

With $3\frac{1}{4}$ drachms and $1\frac{1}{4}$ oz. No. 1 shot, a pattern of 105, penetration of 26 sheets.

With $3\frac{1}{2}$ drachms and $1\frac{1}{4}$ oz. No. 1 shot, a pattern of 100, penetration of 30 sheets.

At 60 yards—

With 3 drachms and $1\frac{1}{8}$ oz. No. 6 shot, a pattern of 110, penetration of 10 sheets.

With $3\frac{1}{2}$ drachms and $1\frac{1}{8}$ oz. No. 6 shot, a pattern of 100, penetration of 11 sheets.

With $3\frac{1}{2}$ drachms and $1\frac{1}{8}$ oz. No. 5 shot, a pattern of 89, penetration of 14 sheets.

With $3\frac{1}{2}$ drachms and $1\frac{1}{8}$ oz. No. 4 shot, a pattern of 70, penetration of 18 sheets.

With $3\frac{1}{4}$ drachms and $1\frac{1}{4}$ oz. No. 1 shot, a pattern of 50, penetration of 21 sheets.

In all the penetrations given here, allowance must be made for the difference in the size of shot when drawing comparisons; for instance, the larger shot has greater penetration or "killing power" than is at first sight apparent. The striking force of No 1 shot is to No. 6 as 60 to 20: for if

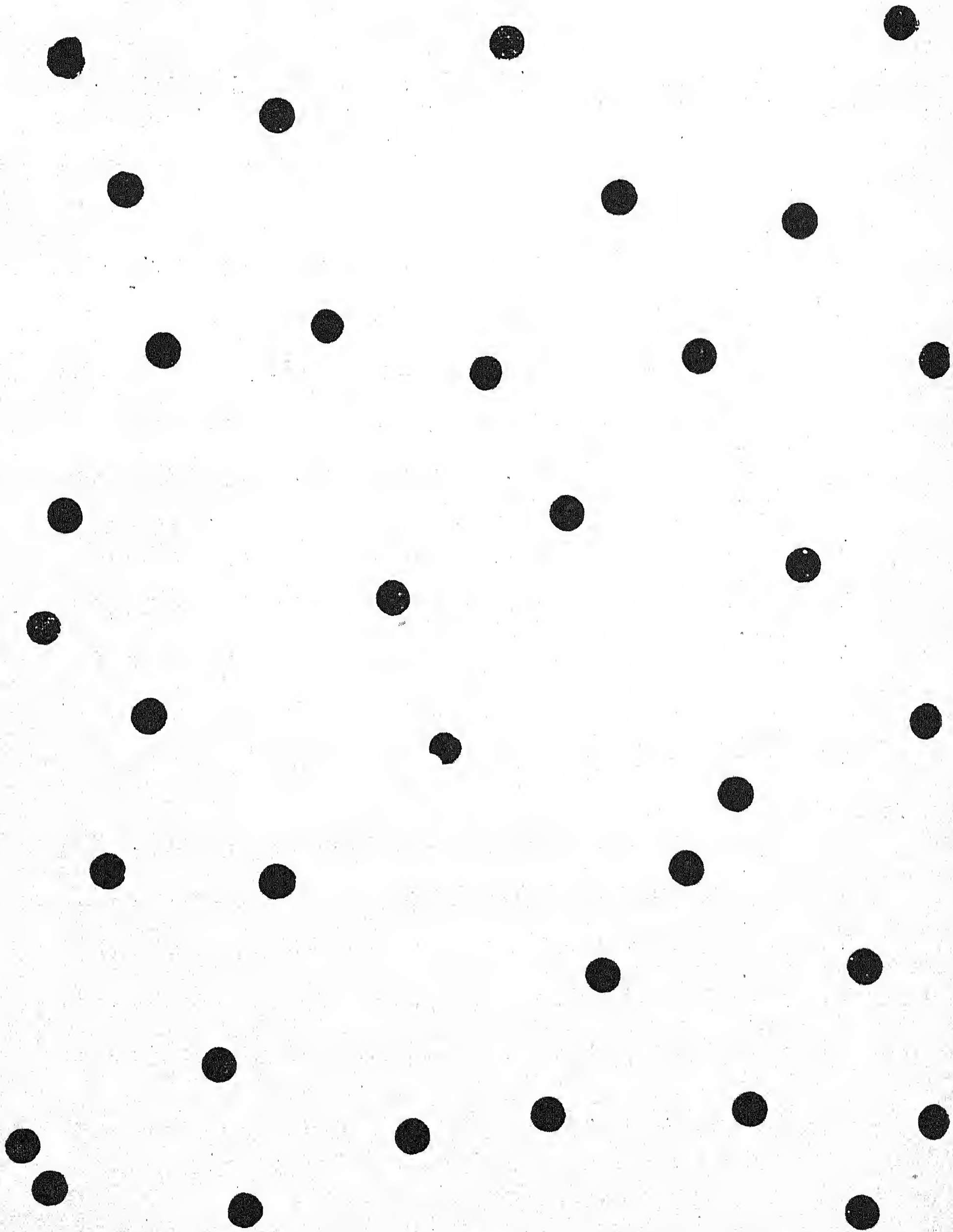


Fig. 277.—Pattern of 12-bore Choke, with $1\frac{1}{8}$oz. No. 6 Shot, at 40 yards.

No. 6 pierces 20 sheets of strawboard, and No. 1, being three times the size and having a proportionately larger surface, pierces but 30 sheets, the holes made in the 30 sheets will be equal to a penetration of 60 sheets with No. 6 shot; the real amount of strawboard *removed* by the No. 1 shot piercing 30 sheets, being equal to three times the amount removed by the No. 6 shot piercing 20 sheets.

The paralysing effect of large shot upon game is well-known; it kills cleaner. The penetration by No. 6 shot of seven strawboards is, as we have already stated, considered sufficient to kill dead all ordinary winged game, and thus the penetration by No. 1 shot of 3 sheets should be equally powerful to kill.

In order for the sportsman readily to comprehend the *thickness* of the patterns made by choke-bored guns, we append two facsimiles of targets. Fig. 277 is the centre square taken from a 30-in. circle, and is equal to a pattern of 230 in the circle. This is a regular shot, not patchy, and will, we think, be deemed close enough for general purposes by most sportsmen.

Fig. 278 is a facsimile of a shot from a 12-bore gun, with No. 8 shot, and is equal to a pattern of 300 in the 30-in. circle.

This pattern is hardly so regular as Fig. 277, but is deemed best by some pigeon-shooters for use in the first barrel.

With No. 5 shot, 12-bore guns make more regular patterns than with No. 6.

EXTRAORDINARY GUNS.

Guns are sometimes required for special purposes, to shoot even closer that those from which the foregoing results have been taken. Professional pigeon-shots, who do not mind extra weight, and exhibition marksmen desire a gun that will *never* fail them if held straight; and it is more especially to these that we have added some most wonderful scores we have obtained from some of our guns, now in the hands of professional marksmen.

To commence with Dr. Carver's 12-bore gun: after being in constant use for two years, it averaged with $3\frac{1}{4}$drs. and $1\frac{1}{8}$oz. No. 6 shot a pattern of 200, with $3\frac{1}{4}$drs. and $1\frac{1}{4}$oz. No. 6 shot a pattern of 220 in a 30-in. circle at 40 yards; at 60 yards with same charge, average pattern, 118; with No. 5 shot at same distance, average pattern, 100.

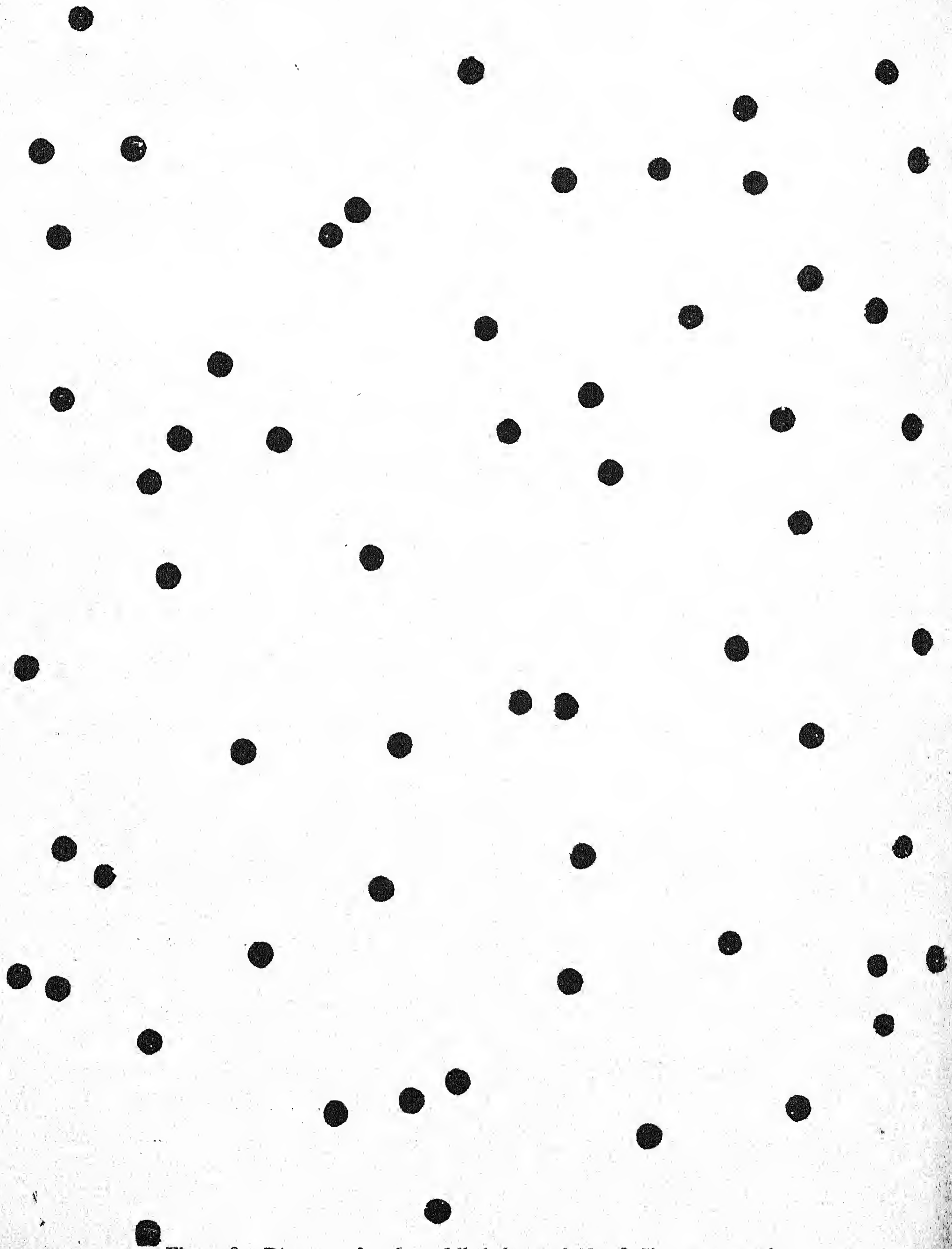


Fig. 278.—Diagram of 12-bore full-choke, and No. 8 Shot, at 40 yards.

Another gun owned by a professional pigeon-shooter, after being used for over two years, both in practice and match-shooting, made with 42 grs. of Schultze powder and $1\frac{1}{4}$oz. No. 6 shot, most regular shooting, the patterns varying from 252 to 266, and an average of 258, with $3\frac{1}{4}$drs. and $1\frac{1}{4}$oz. black powder; average pattern, 246. This gun was 12-bore, 30-in. barrels, weighed $7\frac{1}{2}$lbs., and had been well taken care of.

The shooting had, strange to say, improved since it left our factory; and this and similar occurrences have confirmed our belief that choke-bore guns, if well taken care of, improve in shooting power, by the shot, especially chilled, burnishing the barrel. Both the guns we have instanced had been fired some 5,000 times—more, certainly, than the generality of guns get in two years' game shooting.

Another gun, specially constructed for heavy charges, being 9lbs. weight and having 3-in. chambers, 12-bore 30 in., and firing with comfort $4\frac{1}{4}$ drs. and $1\frac{1}{4}$oz., made very strong shooting, penetrating with 4drs. and $1\frac{1}{4}$oz. No. 6, 22 sheets. The patterns were very regular, and varied from 250 to 260 pellets in a 30-in. circle of 40 yds., putting from 42 to 48 of the pellets in a centre 6-in. square.

A heavy gun, $8\frac{1}{2}$lbs., 12-bore 30 in., made especially for large charges and big shot, for use in rough shooting on the Scotch coast, made an average pattern at 40 yds. with $3\frac{1}{2}$drs. and $1\frac{1}{4}$oz. of No. 6 shot, 30-in. circle of 240, with $3\frac{1}{2}$drs. and $1\frac{1}{4}$oz. No. 4 shot, average pattern 170; with 4drs. and $1\frac{1}{4}$ oz. No. 4 shot, average pattern 175; with 4drs. and $1\frac{1}{4}$oz. of No. 1 shot, average pattern 78.

A 12-bore gun, weighing 9 lbs., made for the varied shooting of Australia, averaged with $3\frac{1}{4}$drs. and $1\frac{1}{8}$oz. No. 8 shot, in a 30-in. circle at 40yds., the exceedingly high pattern of 423; with $3\frac{1}{4}$drs. and $1\frac{1}{4}$ oz. No. 6 shot, average pattern 240; with $3\frac{1}{4}$drs. and $1\frac{1}{4}$ oz. No. 5 shot, average pattern 210; with $3\frac{1}{4}$drs. and $1\frac{1}{4}$oz. No 1 shot, average pattern 110; putting 22 of them in a square 6-in. centre. With heavier charges, as $3\frac{1}{2}$drs. and $1\frac{1}{4}$ oz. No. 6 shot, it made a pattern of 260; with 4drs. and $1\frac{1}{4}$ oz. No. 6 shot, and brass case, the pattern was as high as 263 pellets in the 30-in. circle.

This gun, however, we own to be an exceptionally good one, and we doubt if we could make guns to equal it every day. Such guns require immense labour and care to produce, and often to obtain one of these extra shooting guns we are forced to make several, and choose the best when

finished. It is not chance or fortune that produces one, but care and perseverance in every stage of manufacture. Such shooting as we have just instanced we do not think can have been equalled the world over; *and* although we do not pretend that our ordinary best guns will shoot like the last-mentioned gun, we are prepared to make one to do so, if we have our own time and price.

A 12-bore gun, with 47 grs. of first issue of E. C. powder, gave us some extraordinary patterns with 1¼ ozs. No. 6 shot, averaging 275 pellets in the 30-in. circle. One series of three shots is the highest we have ever obtained from one of our guns, or seen or heard of, with above charge; out of the 368 pellets in the cartridge, 306, 314, and 324 were placed inside the 30-in. circle at 40 yards—an almost incredible result. The cases used were the Greener *Sporting Life*, with usual wads and loading. This gun has since won many prizes on the Continent at important pigeon-shooting meetings.

To show what *has and can be* obtained from a 16-bore, "One who has fired 20,000 shots at marks," writing to the *Field* of October 25th, 1879, states that he has "a 16-bore gun, 28 in. barrels, only 5 lbs. 10 oz. weight," of our make, which he adds "is without exception the finest gun I ever put to my shoulder, and averages a pattern in a 30-in. circle, at 40 yds. and 220 with only 1 oz. of No. 6 shot.

A 16-bore 30-in. barrel gun, 6½lbs. weight, specially made for long-range shooting, averaged a pattern at 40 yds. with 2½ drs. and 1 oz. only No. 6 shot, of 225 pellets in a 30-in. circle. This was certainly an extraordinary performance, but is in proportion with the shooting of the larger bores given above. For the performance of special guns of large bores 10, 8, 4, &c., we must refer the reader to the chapter on "Duck Guns and Shooting."

DUCK GUNS.

Duck and wild-fowl shooting, the only sport that is to be found alike in tropic and frigid zones, calls for guns of special calibre and range, two of which we illustrate in Figs. 279-80. In America the double 10-bore gun is a favourite weapon for duck shooting, and it is also considerably used for the same purpose in England and the Colonies. On account, however, of the 8- and 4-bores shooting the larger shot so much better than the 10-bores,

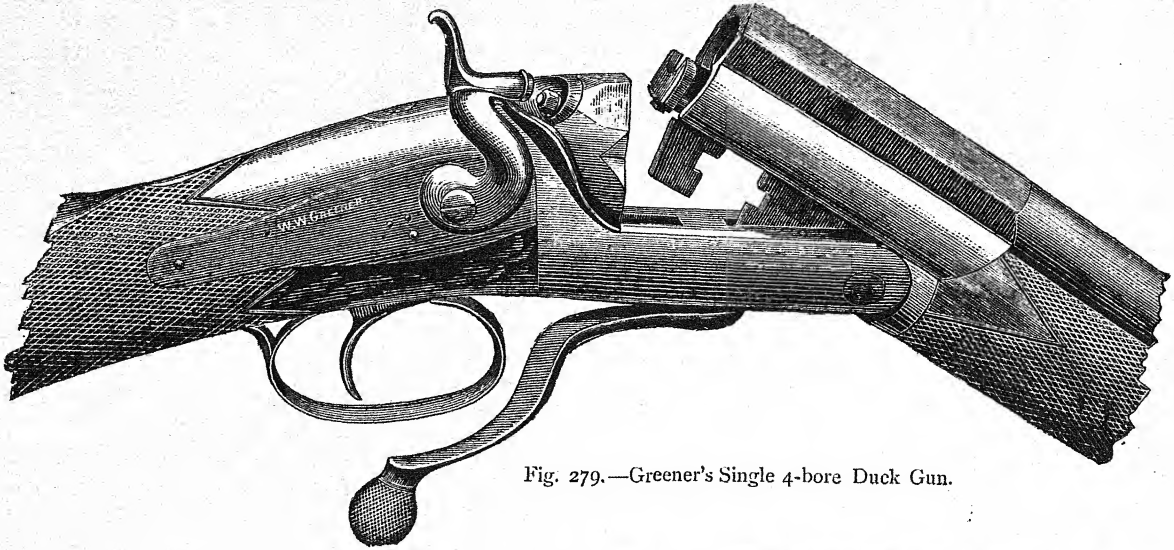


Fig. 279.—Greener's Single 4-bore Duck Gun.

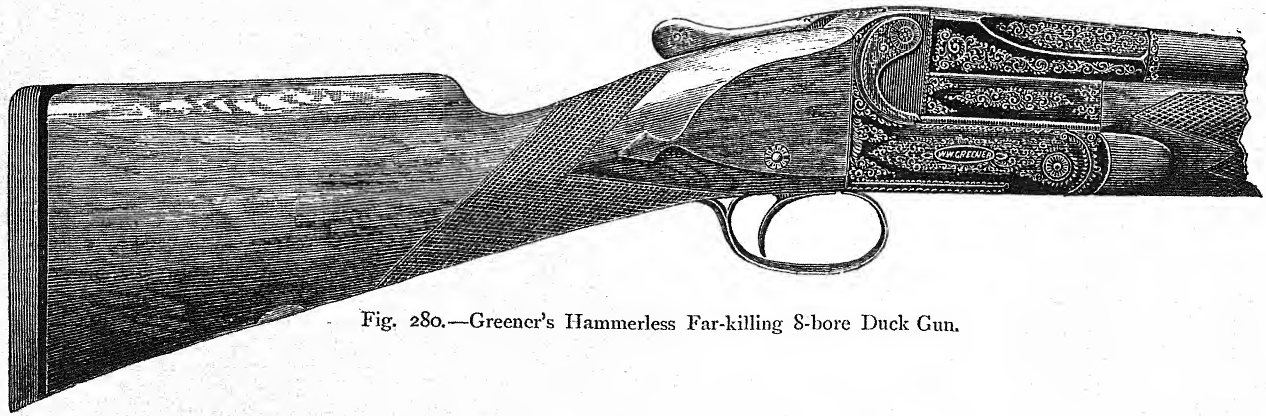


Fig. 280.—Greener's Hammerless Far-killing 8-bore Duck Gun.

they are pronounced the best for wild swan, goose, and general shore shooting.

The 8-bores are sometimes made double-barrelled, and weigh about 14lbs., with 34 in. barrels, and may be made with or without hammers, and on any of our breech-action systems, illustrated in Figs. 178, 243. For very long range shooting, however, single 8- and 4-bore ducking guns are preferred, with the barrel from 36 to 42 in. long, weighing from 15 to 18 lbs.

Until the last two years, the double-grip breech-action was the one solely used for this kind of gun; a rebounding back-action lock was generally employed. This style of gun, of which we still make a goodly number, is illustrated in Fig. 279. The new style, hammerless, with top-lever and cross-bolt, as in all our wedge-fast guns, we illustrate in Fig. 280. The stock is fitted with Silver's anti-recoil heel-plate, and is shown in full, so that an idea may be formed of the relative size of the breech-action and other parts of the gun. The breech-end of the barrel, showing method of bolting to the breech-action, is illustrated in Fig. 291.

Of the advantages of the hammerless system applied to Duck Guns it is almost needless to speak. Besides its greater speed, safety and strength, the ominous click caused by raising the hammer is dispensed with, and many a shot gained thereby. Its neater appearance, and the fact of all the mechanism being protected from blows and water, are also in its favour; and they are strongly recommended by modern wildfowlers, who also prefer double guns to single, if not larger than 8-bore, as they are not necessarily any heavier, and a second barrel is available for shooting at the flock when it is well in the air.

Brass cartridge-cases offer many advantages for use in these large-bore guns. The cartridges, on account of the large charges used, are necessarily cumbrous, but with brass cases there is more room for a larger charge in the same length case as the paper; escape of gas is with them an impossibility; they therefore shoot much stronger, and they will not jamb in the chambers, thus avoiding the chagrin caused by a tight shell and the loss of a second shot. Neither do changes of the atmosphere affect them. In double guns the jar caused by firing the first barrel is apt to shake out or loosen the wad in the second barrel, but this may be prevented by using an indented case, or closing in with a patent *crimper* specially made for these brass cases.

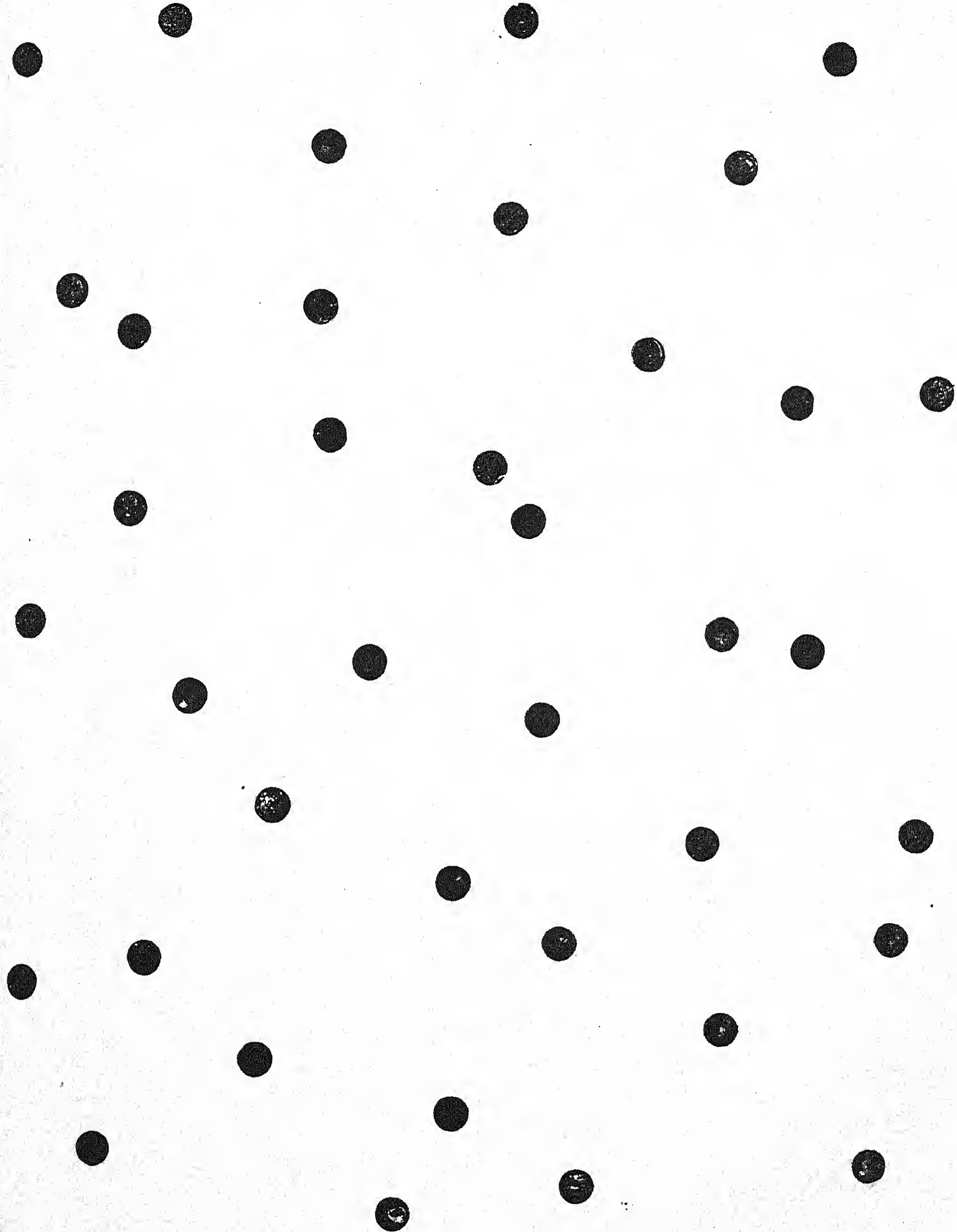


Fig. 281.—Diagram of 10-bore full-choke, with No. 6 Shot, at 40 yards.

It is needless to state that all Duck Guns should be choke-bored. The shooter has generally time for a fair aim—and, indeed, wild-fowl shooting can hardly be termed snap-shooting—and long shots are undoubtedly the order of the day. The 8-bores shoot much better in proportion than do 10-bores to 12-bores, but 4-bores do not improve in the same ratio. These large bores, if choked to the fullest possible extent, give most wonderful results; but the 10-bores, unless used with large-sized shot, are not much closer shooting than the 12-bores. This will be at once seen by comparing the diagram Fig. 281, which is a facsimile of the pattern made with a full-choke 10-bore, 30 in., at 40 yds., with 4 drs. and 1¼ oz. No. 6 shot, with Fig. 277; whilst the highest average pattern attained by us in a 30-in. circle, with the same charge and at same distance, is 275 pellets. This gun weighed 10lb.

It is when shooting large shot that 10-bores show their superiority over 12-bores, and to be really effective they should not be less than 8½ lbs. weight; anything lighter is just as effective if made 12-bore. The following patterns and penetration have been obtained from some of our 10-bore guns, and they may be considered the utmost capability of 10-bores. With 4¼ drs. and 1½ oz. No. 2 shot, pattern in 30-in. circle, at 40 yards, 160 pellets, penetration 25 sheets strawboard. With same charge, but No. 1 shot, pattern 135, 50-in. centre, 12-in. square, a 24-in. circle would have contained nearly all the pellets, as well as the 30-in. circle; penetration 31 sheets strawboard. With same charge, B B shot, a pattern of 88 resulted.

But these patterns are far more than can be expected from the generality of 10-bores. An ordinary full-choke 10-bore, with 4¼ drs. and 1¼ oz. No. 6 shot, will average about 250 pellets, with 1½ oz. No. 4 shot, about 180; same charge, No. 1 shot, about 110. At 60 yards, same charge, No. 4 shot, about 75, penetration 18 sheets; same charge, No. 1 shot, about 60 pattern, penetration 26 sheets.

Without doubt, a double 8-bore full-choked is the *sine quâ non* for duck and wild-fowl shooting, and is the largest weapon that can be well handled by the generality of sportsmen. It should have 34 or 36-in. barrels, pistol-grip stock, and weigh about 15 lbs. Single 8-bore guns weigh from 11½ to 15 lbs., according to the length of barrel. The advantage gained by weight, however, does not compensate for the loss of many second shots, and the difference in first cost is but trifling. We should, therefore, unhesitatingly advise the ordinary wildfowler to provide himself with a

double 8-bore as an all-round weapon. If he has much sport amongst geese and swans, he may also fit himself with a *single* 4-bore as an extra weapon.

We shall now proceed to give the results of many trials we have made with 8-bores, and they may be taken as a fair standard for the ordinary 8-bore gun; but they will, we think, convince sportsmen that the pattern is close enough for all ordinary purposes.

Brass cartridge-cases give the best results, and are in every way the most convenient. The results here given have all been obtained with brass cases, and with three wads between powder and shot. The usual charges are 7 drs. and 2 oz. or 2½ oz. With the first-named, and No. 6 shot at 40 yards, we got 400 pellets in a 30-in. circle; but, of course, this small shot is altogether unsuitable for use in these large bores. Nothing smaller than No. 4, and nothing larger than No. 1, is what we recommend, and which with us have given the best results.

No. 1 shot in one of our choke-bore guns of this bore we can warrant to kill ducks at 130 to 140 yards. The difficulty is hitting the bird; the distance is so great, and the pattern necessarily thin, so that unless held straight, successful shots at this distance must not be looked for; but the velocity and penetration of the pellet is sufficient to kill any duck in air or on water.

With 2½ oz. No. 4 shot, at 40 yards, a pattern of 300, in a 30-in. circle, penetration 34 sheets strawboard; with No. 1 shot, pattern 220, penetration 46 sheets; in a centre, 12-in. square, a pattern of 80 or 85 is sufficient. At 60 yards the penetration, with 7 drs. and 2½ oz. No. 1 shot, is 34 sheets; at 80 yards, 24 sheets; at 100 yards, 16 sheets. Patterns, with same charge, at 60 yards, 130 pellets; at 80 yards, 50; at 100 yards, 18 pellets, all in 30-in. circle.

With No. 1 shot, 5 drs. and 2½ oz., in *paper case*, the pattern obtained at 40 yards was 195 pellets in a 30 in. circle; same charge and distance, but with *brass case*, 225. This is sufficient to prove the great benefit the shooting powers of the gun derive from brass cartridge-cases.

With brass cases, and 7 drs. and 2½ oz. No. 1 shot, the pellets in the 30-in. circle averaged 224; average in centre 12-in. square, 90 pellets. Upon reference to Fig. 282, which is a facsimile of a shot from one of our

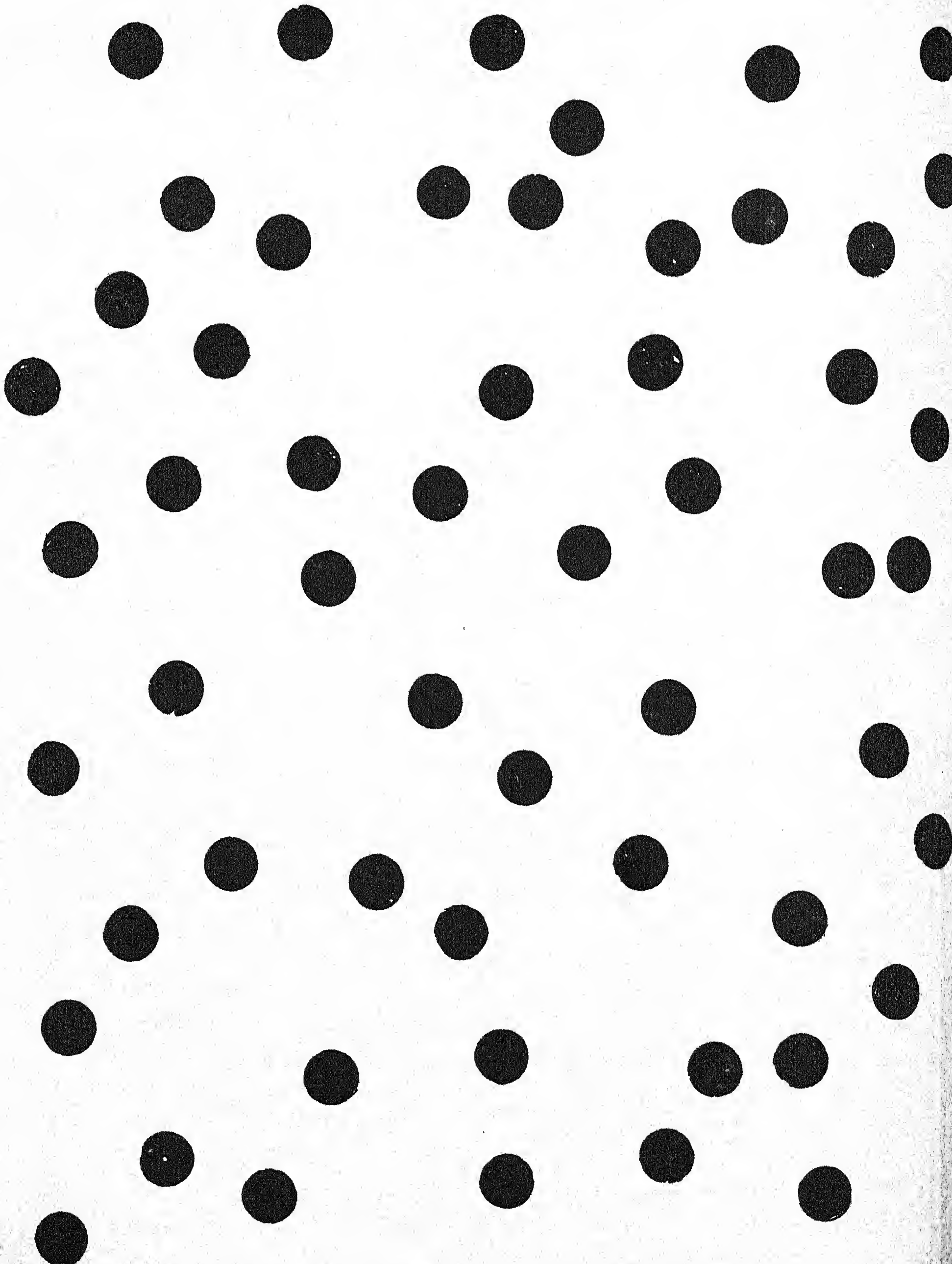


Fig. 282.—Diagram made by Greener's "Far-killing" Duck Gun, 4-bore, No. 1 Shot.

4-bore guns, it will be seen that the pattern is sufficiently close for any purpose.

A 4-bore, at 40 yards, with 11 drs. and $3\frac{1}{2}$ oz. No. 1 shot, will average a pattern of 245, penetration 46 sheets; at 60 yards, pattern 150, penetration 34 sheets; at 80 yards, pattern 65, penetration 24 sheets; at 100 yards, pattern 23, penetration 16 sheets. With 12 drs. and 3 oz. of B shot (80 to the oz.), a pattern at 40 yards of 230, penetration 54 sheets. The 30-in. circle, from which the above patterns are taken, gives but an inadequate idea of the shooting of these large guns. It should be taken from one at least 50-in. in diameter, as the killing circle is so very much larger than that of 10- and 12-bore guns.

The great advantage of the 4-bore is that it shoots a larger charge of shot than the 8-bore, thus giving a wider killing circle. With the large shot A A, B, &c., it also performs better than the 8-bore, and it has the advantage of throwing the pellets well to the centre, as the diagram figure illustrates. The closest pattern yet obtained by us at 40 yards with $3\frac{1}{2}$ oz. shot was 125 pellets on a centre 12-in. square. An 8-bore, with $2\frac{1}{2}$ oz., same distance, put but 90 pellets on the 12-in. centre.

HOW TO CHOOSE OR ORDER A GUN.

A sportsman that is able to enter a well-stocked gun-shop can usually suit himself with a gun after handling several; but those who are unable to do this are often puzzled how to explain their exact requirements, and ensure a suitable weapon being sent.

In choosing a gun for regular English game shooting, the sportsman should look, first of all, to the safety and simplicity of the mechanism, the strength of the action and barrels, and handiness in loading. If he has studied our remarks on modern breech-actions and gunmaking, we think he will be able to judge of the merits or demerits offered by any special arm. Having decided in favour of a particular breech-action and mechanism, the next will be to fit himself with a gun possessing the same. The weight and bore of the gun must be governed by his strength and requirements; if able to carry $6\frac{3}{4}$ or 7lbs. by all means choose a 12-bore, even if it have but 28-in. barrels. The increased size of the killing circle will amply repay a few extra ounces in the weight of the gun; but if unable

to *carry without excessive* fatigue more than 6¼lbs., a 16-bore will be more serviceable in such hands, as unless one can aim and fire a gun without bracing up with a special effort, large bags cannot be expected, and sport deteriorates into nothing more than a disagreeable and uncomfortable exercise.

Twenty-bores, although made as light as 5¼lbs., with 27-in. barrels, have a very small killing circle, and must be in the hands of an expert to do much execution ; and the recoil with the smaller bore, though in reality not so heavy as that of the 12-, often appears to be heavier; it is in fact, sharper, and requires the gun to be firmly held. In deciding as to the weight, it should be remembered that a gun hangs much heavier after a long day's tramp than when handling it for a few minutes in a shop. Have the gun light enough, even at the sacrifice of a couple of inches from the barrels ; the difference to the shooting will be *nil* compared to the advantage gained, but do *not trust a very light, cheap* gun.

The gun, to be safe and yet as light as consistent with safety, must be reduced in size all over. It is a common fault with light, cheap guns that certain parts are dangerously light, and others stronger than necessary; but of course a light gun, with every limb reduced in proportion, cannot bc bought at the same price as a keeper's gun, and a slight mistake in the position of some of the component parts may occasion very serious accidents.

In case of a gun not handling or coming up to the shoulder well, causing the sportsman to shoot under or over the the mark aimed at, it is a common mistake to attribute the whole fault to the length, bend, or cast-off of the stock, whereas it frequently is that the gun is too heavy and beyond the strength of the shooter; if this is the case, it almost invariably results in shooting below fast birds.

The balance of the gun is also an important consideration. If muzzle heavy, low shooting results; if butt heavy, the gun hangs heavily in the hands when being brought to the shoulder. The shape of the heel-plate will also cause the gun to shoot high or low, according whether the toe or the heel stands too prominent. A gun to fit must come up to the shoulder easily and pleasantly, and in a direct line with the object looked at. If whilst looking at a mark, the gun is brought to the shoulder several times, and each time found to be exactly on the mark, it is a "fit," and a

little practice will make the shooter feel quite at home with the weapon.

It is a common mistake with the English and French to use very straight stocks ; this doubtless originates from a liking to the gun first used. We have seen a long-armed Englishman, 6ft. high, cramping himself to fit a short, straight gun similar to the one he used when but a school-boy. Thus it is with the English : having learned to shoot with a short, straight stock when young, they stick to the same throughout life to their great discomfort.

The Americans and Colonists almost invariably use very crooked stocks ; from $2\frac{3}{4}$ to $3\frac{1}{2}$in. is the rule ; for the French market we usually have to make from $1\frac{3}{4}$ to $2\frac{1}{8}$in. ; in England 2in. is considered the *thing*, but a sportsman must never be governed by fashion as to the lay of his gun. If used to shoot with the body and gun at right angles and without bending the neck, a well-bent stock will be a great advantage ; if used to shoot in true English style, with the shoulder well forward and the neck bent, it is not necessary to have so crooked a stock.

If fully decided that the gun used for years is actually a good fit, in ordering a new one nothing better can be done than to send the gun with the order and have one made to match it. This can be done to the greatest nicety. By means of jigs, callipers, and other tools the exact size of the stock and its angle with the barrel is obtained, and this enables the workman, with the assistance of his eye, to form the new gun to the exact proportions of the old one.

The "cast-off" of a gun is the amount the stock is thrown out of truth with the longitudinal axis of the barrels, in a *lateral* direction. Most gun-stocks are twisted over, that is to say, the toe of the butt is more out of truth with the barrels than the heel ; the ordinary amount of cast-off is 3-16ths for the heel and 3-8ths for the toe. The object of the cast-off is to bring the centre of the barrels in a line with the shooter's eye, without pressing the cheek hard against the stock. The stock being always cast off to the right has a tendency to make the barrels shoot to the left—more especially the left barrel ; although the pull-off corrects this tendency in a certain degree. It is a mistake to have the stock cast-off more than 3-8ths of an inch ; a more crooked stock, with the same cast off, effects the same end more satisfactorily.

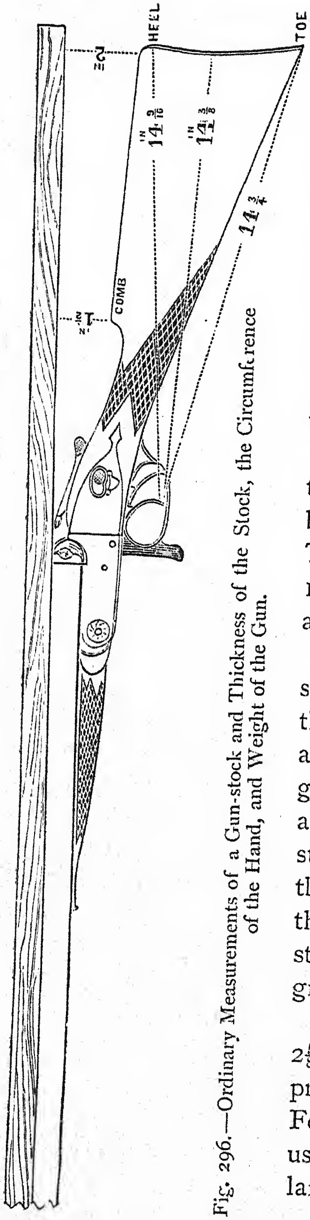


Fig. 296.—Ordinary Measurements of a Gun-stock and Thickness of the Stock, the Circumference of the Hand, and Weight of the Gun.

To take the measurements of a gun-stock, and to ensure a similar gun being made, the following will be necessary—the bend, length, and depth of butt:—

To take the bend, proceed as follows:—Obtain a piece of wood or iron with a perfectly straight edge, sufficiently long to reach from the sight on the muzzle to the extremity of the butt; lay this straight-edge along the rib, and measure the distance from A to *heel*, and from B to *comb*. This is the bend. The lengths required will be from the fore or right-hand trigger to the *heel*, *centre*, and *toe* respectively, and the depth from the heel to the toe.

The circumference of the hand may be obtained by passing a string round it immediately behind the trigger guard, and measuring the string. The usual hand is about 5-in. in circumference for 12-bores; the length from the face of the breech-action to the comb is about 7-in.

Gunmakers take all their measurements as shown in Fig. 296, the lengths being taken to the centre of the heel-plate, or extreme length, and not to the edge of it. The measurements given on Fig. 296 are in due proportion, and are as usually made for the home trade. A long stock can be held more firmly to the shoulder than a short one, and the *shock* of the recoil is thus lessened. The pistol and half-pistol grip-stocks also allow of a firmer and more comfortable grasp being taken.

The chambers should not be extra long; the $2\frac{5}{8}$-in. chamber is sufficient for 12-bores, and is in proportion with the usual length of the barrels. For 10-bores the $2\frac{7}{8}$-in. case should be the longest used. If these cartridge-cases will not contain large enough charges, it will be better to use

brass cases than to have longer chambers. The shooting with the first is rendered better, with the latter worse.

With regard to the shooting, a gun more or less choked is now invariably used. We have already recommended a full-choke for all purposes, and in the hands of a competent sportsman there is no doubt about its being the most effective weapon. If a full-choke is too close shooting for the sportsman, he will do better with a well modified choke-bore than with one nearly full. The reason for this is that modified or nearly full-choked guns shoot, with very rare exceptions, very irregular, and a difference of 10 or 20 pellets in a 30-in. circle can be of little importance, the killing circle itself being increased in size only to a slight degree. Therefore, if a good shot, have a full-choke with both barrels. If but an indifferent shot, and used to shoot at close quarters, one barrel should be modified to almost a cylinder; and for those sportsmen who have the disadvantage of a short sight, this gun will prove the best. If a bad shot, have both barrels modified almost to a cylinder.

The technical mode of expressing the shooting of a gun is to give the number of pellets put into a 30-in. circle at 40 yards' range, with $1\frac{1}{8}$ oz. shot for 12-bores, and the standard charge for other bores. This will be understood by all English gunmakers without further particulars.

In ordering a gun, the shooting required may be expressed by stating left barrel 220, right barrel 160, more or less, as the person ordering may require, and state size of shot to be used.

The "Field" force-gauge is now in general use amongst the first-class gunmakers, and the penetration may be ordered by paper pads, or striking force by the machine, although a good pattern is of itself an ample guarantee of good penetration.

For the convenience of gentlemen residing in foreign lands or in country districts, we have adjoined an order form to our price list, which will be found at the end of the book, and if all the spaces left there be properly filled up, we can answer for the gun being as the orderer desired.

THEORIES AND EXPERIMENTS.

HOW TO LOAD CARTRIDGES.

THIS to the sportsman is a matter of great importance. We have already recommended a full choke-bore gun for the first-rate shot, and we shall now endeavour to show how it may be loaded, so as to suit all kinds of game, and to develop the greatest powers of the gun with a minimum of waste.

For a 20-bore gun let the standard charge be $2\frac{1}{4}$ drs., No. 4 powder, 1 pink-edge, 1 felt—one-fourth of an inch thick—1 thin cardboard, making in all a wadding three-eighths of an inch in thickness; then 1 oz. No. 6 chilled shot, and a *very thin* cardboard wad. A 20-bore gun with this charge, if loaded with Nos. 6, 5, or 4 shot, is a good gun, available for general shooting up to 50 yards' distance. With larger shot than No. 4 the charge of powder may advantageously be dropped to 2 drs., and with the regular size shot some sportsmen deem seven-eighths of an oz. a sufficient charge. It is also a matter of little importance whether the third (cardboard) wad be used over the powder or not.

For a 16-bore gun we think $2\frac{1}{2}$ drs. of powder and 1 oz. of shot a sufficient charge; but in some instances where the gun is heavy, $2\frac{3}{4}$ drs. may be used. The remarks apply to wads, as made to the 20-bore above. The advantage of the 16 over the 20-bore is that it makes a larger killing circle, and shoots the Nos. 5 and 4 shot more evenly.

For a 12-bore gun the standard charge is 3 drs. and $1\frac{1}{8}$ oz. shot, and is recognised as *the thing* for all game shooting until late in the season, or when game is wild; then increase the charge of powder to $3\frac{1}{4}$ drs., retaining the same charge of shot, and stronger shooting will result.

With 3 drs. and $1\frac{1}{8}$ oz. we have found 1 cardboard, 1 felt—$\frac{3}{8}$ in, and another cardboard wad between powder and shot, to answer as well as any; but when using $3\frac{1}{4}$ drs. and 1 oz., we substitute a pink-edge for the first cardboard wad, and this we find to develop this charge of powder better than any other combination of wads. We were the first to use this

manner of loading with this charge, having discovered its special merits at the London "Field" gun trials of 1875.

The charge of $3\frac{1}{4}$ drs. and $1\frac{1}{8}$ oz. shot, *by weight*, is the heaviest charge ordinary 12-bore guns will stand, and it is with this charge that they give the best and most even results. Occasionally, we have guns that will shoot $3\frac{1}{2}$ drs. $1\frac{1}{8}$ oz., but most guns have a tendency to *scatter* the pellets with this charge. Of course the safety of the gun is not questioned, it is only the shooting. For perfect, close, even, and regular shooting do not use more than $3\frac{1}{4}$ drs. $1\frac{1}{8}$ oz. shot.

Pigeon guns, or heavy 12-bores, made to shoot $1\frac{1}{4}$ oz. shot, may be used with $3\frac{1}{2}$ or even 4 drs. powder; but to obtain the closest and most even shooting it should never exceed the latter. These charges are all given for the best English gunpowder. In America the powder ordinarily sold is inferior to the English in strength, so that the charges may advantageously be a little heavier. To get greater penetration, it is better to use larger shot than to cram in heavy charges of powder; as proved by our experiments, it is impossible to drive small shot with the same velocity as large, and No. 8 can never equal No 5 for penetration.

When testing penetration at strawboards, we have frequently found equally as good penetration from $2\frac{1}{4}$ and even 2 drs. of powder and No. 5 shot, as we have with 3 drs. of powder; thus it seems that overloading is the fault to be guarded against.

We can recommend our readers to try a charge of $2\frac{1}{2}$ drs. and $1\frac{1}{4}$ oz. No. 5 shot: it results in a larger killing circle, and a more even distribution of the shot than the heavier charges of powder and less shot. Heavy guns may be loaded with $2\frac{3}{4}$ drs. and $1\frac{1}{2}$ oz. to give the same results. For 10-bores, when using shot smaller than No. 6, $1\frac{1}{4}$ oz. will be sufficient, and a charge of $4\frac{1}{4}$ drs. strong powder—this for regular shooting. For duck and long-distance shooting, $4\frac{1}{2}$ drs. may advantageously be used. Two or three wads between powder and shot, and one over shot, as described for 20-bores.

When Nos. 5, 4, 1, or larger-sized shot is used, the charge of powder generally best adapted is $4\frac{1}{2}$ drs. and $1\frac{1}{2}$ oz. of shot.

Such large charges as 5 and $5\frac{1}{2}$ drs. of strong English powder seldom means better shooting, but an increase on the wear and tear of the gun.

For 8-bores, with shot up to No. 2, we usually load with $5\frac{1}{2}$ or 6 drs. No. 4 powder, and 2 or $2\frac{1}{4}$ oz. of shot; with the large shot, an increased

charge gives better results, but we do not recommend heavier charges than 7 or $7\frac{1}{4}$ drs. of powder and $2\frac{1}{2}$ oz. of shot.

For 4-bores the usual charge is 11 drs. and 3 oz. of shot. As these guns are only required for close shooting, very little latitude with respect to the charges is required, and 12 drs. and $3\frac{1}{2}$ oz. is the heaviest charge that can comfortably be sustained by the shoulder.

In recommending all these loads, we have been guided as much by the *regularity* of shooting required as the strength. Greater velocity and penetration to a few individual shots may be obtained, doubtless, with more powder, but not without sacrificing regularity of pattern and penetration.

WADDING.

We now come to the much-vexed question of wadding. What constitutes good wadding? And is good wadding essential? It is the office of wadding to create an impenetrable barrier between the powder and the shot, and to prevent, if possible, the gases from the explosion mixing with and disseminating the shot. Expansive wadding is best to accomplish this, but it is doubtful if the great importance attached to very tight wadding is warranted by the results obtained from its use. When the felt wadding was introduced, it was intended, *per se*, to form a gas-tight partition between powder and shot, and was made to slip easily down the muzzle-loaders; the *explosion* tightening the wad. In breech-loaders the same laws apply, but of late many erroneous notions have become current respecting wadding; the cardboard wad was at first used to prevent the grease from the felt wad injuriously affecting the powder, but now some makers say it is used to improve the shooting!

Others contend that to get the best shooting, the wads *must* be from $\frac{1}{4}$ to $\frac{3}{4}$ths of a size larger than the case, speaking learnedly of expansion, bridging over chasms, burning at the edge, &c.; forgetting that a thin, loose felt wad expands as fully as a tight one, and that the elasticity of felt wads is such that one, three-fourths of a size larger than the bore of the cartridge-case, may be easily compressed with the fingers until it is of the size of the case, the wad gaining in thickness what it loses in diameter. With loose wads, the reverse takes place upon the explosion; the blow given the wad is more sudden than any that can be given by hand, and it is,

as it were, "jumped up," the wad diminishing in thickness but expanding as much as the *barrel* will allow, and a tight wad can expand no more.

We have spent many hours experimenting with tight, loose, pink-edge and felt wads, the result being that some days one, and some days the others performed the best, to the extent of 10 or 12 pellets. It is the fickleness of guns more than wads that must be considered. Some person shoots a few shots with tight wadding, obtains good results, and immediately publishes them; if he had tested them again and again against loose wads, we think the beneficial results would not have been so apparent. We think a difference in the *quantity* and *quality* of fulminate in the caps affects the performance, and many results attributed to wadding could be traced to this cause alone.

That even the mixing of the gases with the shot does not scatter the latter, as generally supposed, is proved by the fact that in a choke-bore gun, with 3 drs. of powder and $1\frac{1}{8}$ oz. of shot, with *no wad whatever* between powder and shot, we have repeatedly gained a pattern of over 100 pellets in a 30-in. circle at 40 yards; with an ordinary wad of *newspaper* between powder and shot, a pattern of 110; with a single cardboard wad between, a pattern of 120; with a pink-edge wad only, a pattern of 150; with 1 thick felt, from 200 to 230, according to the amount of choke; and yet some gunmaker asserts that unless *tight* wads are used, the pattern of even a good choke may be so thin that partridges and rabbits can escape at *fifteen or twenty yards!*

If a felt wad only is used between powder and shot, it is singed and partly burnt by the explosion; the depth of the burn is dependent upon the charge, and the texture and quality of the wad, but in no case have we seen a wad burnt through, and the burn is deepest in the centre, the edges being comparatively unaffected. A grease-proof or a hard pink-edge wad next to the powder and before the felt is doubtless beneficial, but the utility of a cardboard wad over the felt we fail to see, as the felt is not soft enough to permit the shot to bury themselves in it. The wadding we recommend is a grease-proof, pink-edged wad next to the powder, followed by a felt, tough and flexible, $\frac{3}{8}$ths of an inch thick for 12-bores, and thinner or thicker in proportion as the bore increases or diminishes; $\frac{1}{4}$ in. is suitable for 20-bores, $\frac{1}{2}$-in. for 8-bores. The wads should slip nicely into the cases; it is a mistake to have them so large as to bulge paper cases, and useless to

have them too small; the thinner the wad over the shot, the better for good shooting.

Our reason for using a good thick wadding between powder and shot is, that an elastic wad of sufficient body starts the charge of shot more slowly, and allows it to gradually increase its velocity until reaching the muzzle. The usual charge of $1\frac{1}{8}$ oz. by weight appears too little shot for a 12-bore gun, and when using it with upwards of 3 drs. of powder, we always used the thick wadding, as it appears to develop the force of the powder better. With $1\frac{1}{4}$ oz. of shot and upwards, we find less wadding to give equally as good results.

In the United States, two pink-edge wads are generally used between powder and shot, and as good results are obtained as with our felt wadding.

To load choke-bore guns so as to scatter the shot at close quarters has

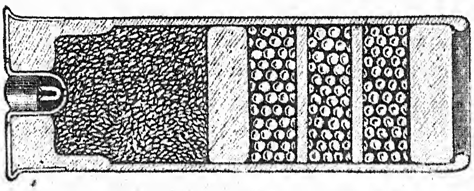


Fig. 297.—Cartridge loaded to scatter the Shot.

always been a difficult matter to accomplish. The rule is to diminish the thickness of wadding between the powder and shot, and increase it over the shot. This is pretty effective, but the best plan we find to be that illustrated in Fig. 297.

The charge of shot, it will be seen, is separated by two cardboard wads. This will cause a full-choke-bore gun to make a pattern of 140 at 40 yards instead of 220. A still smaller pattern may be obtained by using 1 oz. of shot instead of the ounce and eighth, and still further by substituting No. 5 for No. 6 shot. If it scatters too much, separate the shot by one wad instead of two, or by simply using one pink-edged wad only over the powder, and one or two over the shot.

The scatter-charge has good penetration at 30 and 40 yards, but of course not so much as when loaded for close shooting.

For rabbit shooting, with a full-choke-bore gun, at 15 and 20 yards'

distance, very successful results have been gained by reducing the charge of shot to ½ oz., the smashing of the game being thus avoided.

Many devices have been resorted to from time to time to increase the range of shot-guns. The most noted are concentrators, wire and bone-dust cartridges; all of these appliances are, however, utterly useless in choke-bore guns. In cylinder guns, wire cartridges and concentrators may be beneficial, but are liable at times *to ball.* In choke-bores they destroy the choke, cause greater recoil, and give worse patterns and penetration than is obtained from ordinary cartridges.

The least objectionable practice resorted to is the pouring of melted tallow amongst the shot in the cartridge before placing on the wad. Slightly better patterns and penetration sometimes result from this, but it will also occasionally cause "balling," and thus the advantage gained is more than counteracted.

To select buck-shot, put a wad in the muzzle of the gun, about half-an-inch down, and fit the shot in perfect layers. If this is observed, there will be no need to try them in the cartridge-case; it is immaterial whether they fit there or not. Indeed, all shot should fit in perfect layers at the muzzle in a choke-bore, as better shooting is thereby gained; but with large shot it is a necessity with a choke-bore, and must not be overlooked.

We find that buck-shot of 9 to the 1⅛ oz. (3 in a layer) will generally fit a 12-bore full-choked gun; if smaller shot is required, choose 4 or 5 to a layer, avoiding intermediate sizes. We have tried these at 40 yards, and all the pellets have been placed in a 2·5-in. circle.

The A A A shot is well liked in Cape Colony; S S G and S S S G are also in favour. If of chilled shot, the penetration is equal to a pea-rifle, and the Cape spring-buck has frequently been killed with them at a distance of 100 yards.

SHOT.

Drop-shot is made in several sizes, varying from about 3,000 to 40 per oz. Only shot of a regular size and uniform shape should be used; it is a mistake to mix the sizes. Some sportsmen are in the habit of so doing, but irregular shooting results.

The shot must also be hard, to retain its shape, especially for choke-bores. There is no probability of lead ever injuring a barrel; the lead,

however, may be mixed with spelter or some hard mineral, and thus injure the barrel.

The best shot to use for all purposes is the *Newcastle Chilled Shot.* It is very uniform in size, is as perfectly spherical as possible, and is made wholly of lead. Other makers are selling *hard* shot, so rendered by the admixture of other substances than lead. Such shot is lighter than the chilled shot, and likely to have a deleterious effect on the gun-barrels.

In comparing results of gun trials, much care must be taken, owing to the shot being of different sizes. Most makers have two or three sizes of No. 6 shot, and even the standard sizes of the leading makers differ. The No. 6 shot made by the Newcastle Chilled Shot Company contains 270 pellets in the oz., and we will use no other. Another No. 6 is made by the same company for the Liverpool market, containing 300 pellets per oz.

The following are the standard sizes of the two leading makers :—

Lane and Nesham, London.		Newcastle Chilled Shot Co., Gateshead-on-Tyne.	
Size.	No. of Pellets to the ounce.	Size.	No. of Pellets to the ounce.
A A A A	30	A A A	40
A A A	35 to 40	A A	48
A A	40	A	56
A	45	B B B B	56
B B B	50	B B B	64
B B	58	B B	76
B	75	B	88
1	80	1	104
2	112 to 120	2	122
3	135	3	140
4	175 to 180	4	172
5	218 to 225	5	218
6	278 to 290	6	270
7	340	6*	300
8	462	7	340
9	568	8	450
10	985	9	580
Dust.	1672	10	850
*S G	11	11	1040
*S S G	15	12	1250
*S S S G	17	Large Dust.	1700
*L G	5½	Small Dust.	2800
M G	9	S G	8
—	—	S S G	11
—	—	S S S G	14

* Walker, Parker & Co. London sizes.

STANDARD SIZES OF AMERICAN SHOT.

SIZE.	T. O. LEROY & CO.	TATHAM, BROS.	ST. LOUIS SHOT TOWER.	CHICAGO SHOT TOWER.	SIZE.
T T	32 to oz.	31 to oz.	33 to oz.	27 to oz.	O O O
T	38 „	36 „	39 „	33 „	O O
B B B	44 „	42 „	46 „	38 „	O
B B	49 „	50 „	51 „	46 „	B B B
B	58 „	59 „	60 „	53 „	B B
1	69 „	71 „	71 „	62 „	B
2	82 „	86 „	90 „	75 „	1
3	98 „	106 „	100 „	92 „	2
4	121 „	132 „	118 „	118 „	3
5	149 „	168 „	159 „	146 „	4
6	209 „	218 „	237 „	172 „	5
7	278 „	291 „	299 „	216 „	6
8	375 „	399 „	385 „	323 „	7
9	560 „	568 „	509 „	434 „	8
10	822 „	848 „	700 „	596 „	9
11	982 „	1346 „	1103 „	854 „	10
12	1778 „	2326 „	—	1414 „	11
—	—	—	—	2400 „	12

Occasionally discrepancies are found in the sizes of the shot. We have several times tested the sizes by counting, the most regular being the Nos. 5 and 6.

In making the shot, which is done by pouring molten lead into a sieve and allowing it to fall down a tower or shaft into water, there is a certain per-centage of pellets imperfectly shaped ; these are re-cast by good makers, but in inferior shot they are frequently to be found.

Different-sized sieves are used to cast the different-sized shot, but there is always some of either the No. above or below in every cast ; thus it all requires sieving *after* being cast. Pellets that are too large or too small for any sizes, are re-cast with the badly-formed shot.

The American shot is not so regular, either in size or shape, as the English, and frequently there is a discrepancy between the printed list of the manufacturers and the sizes given in some leading sporting works. Tatham's list gives his size as No. 6, 218 ; No. 7, 291 per oz. Thus the American No. 7 shot is more equal in size to our No. 6, whilst their No. 6 is about equal to our No. 5.

In America, shot is sometimes cast by dropping the shot down a shallow shaft, through which a strong current of air is driven upwards ; the current

retards the fall of the shot, thus removing the necessity for a deep shaft; and shot so made is said to be harder than ordinary shot made with the long drop.

GUNPOWDERS.

Gunpowder, since being granulated, has been manufactured of various sizes of grain. For large cannons the cubes of gunpowder are 1·5in., as we have already illustrated, and the various sizes from R, F, G, to P2, are used in arms of different calibres, the size of grain being now deemed an important consideration with artillerists. Nor is it of less importance to the sportsman.

Upon the size, density and quality of his powder depends, in a great measure, his success.

Of late years it has been the rule with modern sportsmen to employ only a large-grain powder, as No. 4 or 6, only a few of the most conservative retaining the old-fashioned fine-grained powders.

For general use in 12-bore guns we find the No. 6 powder too large, and not sufficiently quick in its action.

A great deal of the quickness of the firing is doubtless due to the shape, density and quality of the grains as well as the size. To determine the relative merits of gunpowders the "Field" Trial of explosives in 1878 was undertaken, but beyond proving the safety of Schultze wood-powder, and the merits and demerits of certain guns with various powders, nothing decisive resulted, each maker claiming the advantage for his powder. Our observations, however, determined us that No. 6 powder will give very regular shooting in shot guns, but has not sufficient velocity to cope with the smaller powders.

Small-grained powders, whilst giving great velocity, generally cause the pellets to scatter much more rapidly than large-grained powders. Our theory for this is, that the finer powder burning more quickly has expended all its force before driving the shot as far as the muzzle; whilst the larger-grain caused the shot to increase its velocity right up to the muzzle of the gun.

The shape of the grain affects materially the combustion of the powder, the sharper diamond-shaped grains burning more rapidly than the rounded ones.

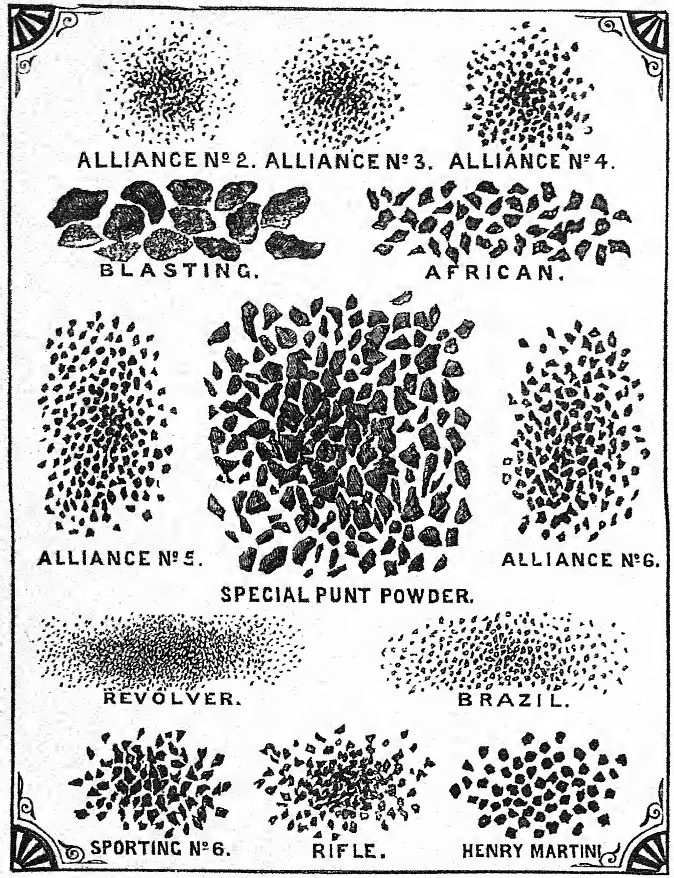


Fig. 298.—Pigou, Wilks and Laurence's Gunpowders.

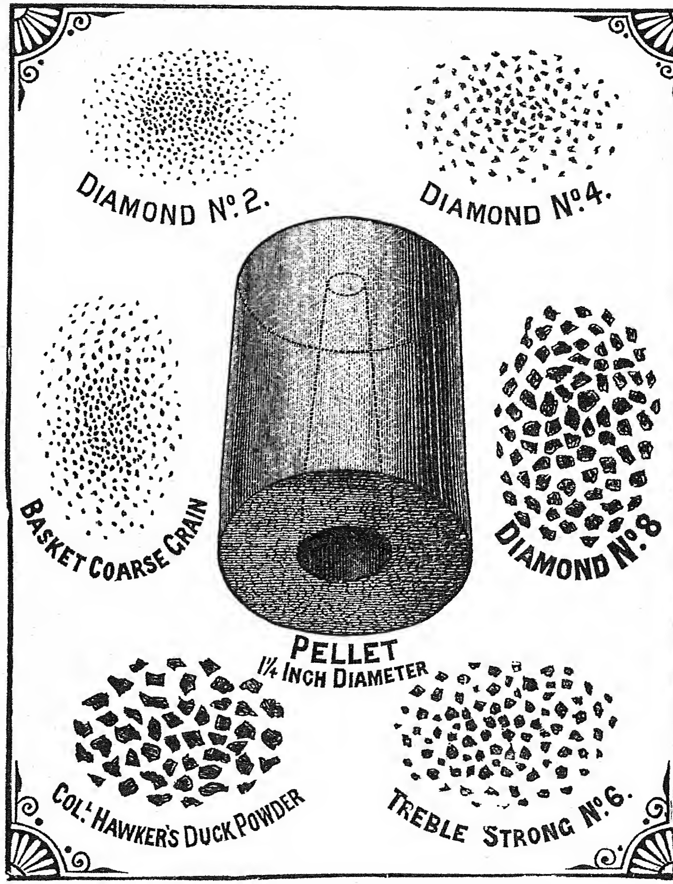


Fig. 299.—Curtiss and Harvey's Gunpowders.

For use in shot guns, however, doubtless the *ne plus ultra* gunpowder consists of grains of various sizes and shapes, as the "Alliance" powders of Messrs. Pigou, Wilks and Laurence, and the "Basket" powders of Messrs. Curtiss and Harvey.

With the former we have been very successful, both at the London gun trials and in private experiments; indeed, we found the No. 4 "Alliance" powder so suitable for our guns of ALL bores, that for several years we used scarcely any other, experimenting, however, with grains of all sizes and shapes.

We show the respective sizes of the grains of the two leading English powder-makers in Figs. 298 and 299. We have but few remarks to offer upon such well-known powders as the Diamond Grain, Basket, Treble Strong, Challenge and Alliance. The "Basket" and "Alliance" are supposed to kill the cleanest and possess a higher velocity than the Treble Strong; the difference, however, is not great.

In Duck guns of 8- and 4-bore, and in 20-bores of the lightest construction, we have found the No. 4 Alliance Grain to give excellent results, and do not recommend a much larger or smaller grain.

For Punt guns the Col. Hawker punting powder, made by Curtiss and Harvey, has a good reputation; a larger-grained powder, known as Col. Latour's, is made by the same firm. A well-made powder for Punt guns is Messrs. Pigou's special Punting powder, the grain coming between the sizes of Col. Hawker's and Col. Latour's.

For blasting purposes a large-grained powder is preferred in England: see Fig. 298; or a single pellet of compressed powder resembling a dynamite cartridge: see Fig. 299. This latter has been but recently introduced, and is made in 3 sizes—1, 1¼, and 1½ inches in diameter.

For export purposes the grain "African," Fig. 298, is preferred. The powder marked "Brazil," is that usually exported to South America; it is highly-glazed and more prized on that account, but is of very inferior quality. Travellers may note this, and not purchase this attractive powder if any other is to be obtained. For trading, however, it is more highly prized than far more expensive powders.

Whilst on this subject we may mention that in France the gunpowder is of the vilest, small in grain, dirty, quickly fouling the barrels, and apt to bulge all but the best. We illustrate it for comparison in Fig. 300.

It is current in all French possessions, and is one of the evil results of government monopoly. English or foreign gunpowder of any make is not admitted into France under any conditions. The Rifle powder is of better quality, but it can seldom be obtained in any quantity. The best brand to get is B, and for shot guns a very fair nitro-compound, similar to "E. C." or Schultze powder, is made by the French Government, and English cartridges can be purchased in Paris. In Spain English powder is to be had, in many parts Spanish powder also; the quality of the latter varies according to locality. In Norway and Sweden very good gunpowder is made, but almost entirely for home consumption. In Germany, also, powders of various qualities are to be

Fig. 300.—Foreign Gunpowders.

obtained; some are fully equal to, if they do not surpass our own. The grains are of various sizes, the powder being very clean, as represented in Fig. 300, and not full of dust, like the French powders.

We have experimented extensively with the German powders of Rothweil, as also with those of Cramer and Bucholz, and the celebrated "Diana" powder. The Diana certainly gives good patterns, but falls off in regularity and strength, so far as our trials have gone. The round-grained powder of this firm is not equal to the angular-grained powders for shot guns or rifles, the force on field-gauge being as 1·97 round grain; to 2·71 with their very fine grained powder—about No. 3; and to 2·11 of the No. 4; whilst the Alliance is 3·02 under same conditions. Compared with No. 4 Alliance all show to a disadvantage in most of our guns, and leave the barrel quite as foul after firing. We have also tried the powders of Westfield Bros., Hay Merricks, and various other makers, but see no reason to depart from the opinion already expressed in this article.

Messrs. Hall have recently introduced a mixed grain gunpowder, as Fig. 301. It is supposed to combine quickness of ignition with continued combustion; the results obtained have not been uniform, possibly owing to the fact that in transit the grains being of different sizes are likely to dissemble, and all, or the majority of a charge in one cartridge, being large grains, and the next small.

In the United States a large variety of gunpowders are at the option of the sportsman. They do not, however, appear to be so clean as the English. American sportsmen may choose a grain resembling as near as possible the No. 4 Alliance for general purposes. The Orange Lightning and Laflin and Rands' (see Fig. 300) we believe to be as good as any of American make.

Fig. 301.—Hall's Mixed Grain Powder.

For rifles a large-grained powder is essential to good shooting. No. 6, or the Martini-Henry or Snider powders (Fig. 298), will convey an idea as to size; the grains should be sharp, angular, and hard.

A special powder known as U.S., is made by Messrs. Curtiss and Harvey for the express use of match-rifle shots; being made from inferior charcoal it fouls rapidly, and burns very slowly. It was first made in the United States, being introduced into this country by American visitors to Wimbledon. It is said better shooting is obtained with it, but the rifle must be cleaned out after every shot.

The strength of gunpowder has from the middle ages been a difficult matter to ascertain. In 1857 Bunsen and Scluskoff determined that gunpowder, exploded in a confined space, generated a pressure of 4,374 atmospheres, or 29 tons per square inch, and the heat evolved by the explosion to be 5·980 deg. F.

In 1874 Captain Noble and Professor Abel pronounced the temperature of the explosion to be 4,000 deg. F. (2,200 deg. C). The gases generated equal to about 6,400 atmospheres, or 42 tons pressure to the square inch.

For all general purposes the ordinary tests for density, muzzle and initial velocity are enough; and form at least comparative conclusions as to relative strength and merits of the different powders. Moisture affects materially the velocity of the powder, so that to be correct all experiments must be made with powders having the same per-centage of moisture. The density of the powder likewise affects the velocity, so that in reality the velocity is the only certain test, and it will immediately detect any disparity in density and strength. The velocities of powders with rifles have been many times tried, and we have recently tried our shot-guns in the same manner.

Before detailing these velocities, we may, perhaps, advantageously describe the instrument and method by which the various velocities are ascertained.

The Bouléngè chronograph—the one most generally adopted—consists of a falling rod, knife, electric battery, gun-rest, and various other paraphernalia connected with each other and the battery. The rifle or gun is fixed in an adjustable table-rest, similar to the Whitworth, and across the muzzle of the arm is stretched a copper wire, which is broken by the passing bullet. The target is fixed at exactly 120 ft. from the muzzle, or such other distance as may be determined upon, and is supported by a fine wire, which is broken immediately the target is struck by the bullet or shot. Both the wire from the muzzle and from the target run to the chronograph, which we show in Fig. 302.

From the two points, two rods are suspended and kept from falling by the magnetic attraction caused by the current passing through the machine. On the longer rod is slipped a zinc tube; a spring knife is set and kept at cock by a scear; the shorter rod is suspended over this scear, and is such that, upon the rod falling, the knife is liberated. The current which supports the longer rod is severed immediately the bullet breaks the wire at the muzzle of the barrel, and the shorter rod upon the wire at the target being severed, the longer rod in falling passes close to the spring knife, so that upon it being liberated it marks the zinc tube upon the longer rod; and it is upon the distance that the longer rod has fallen before marked by

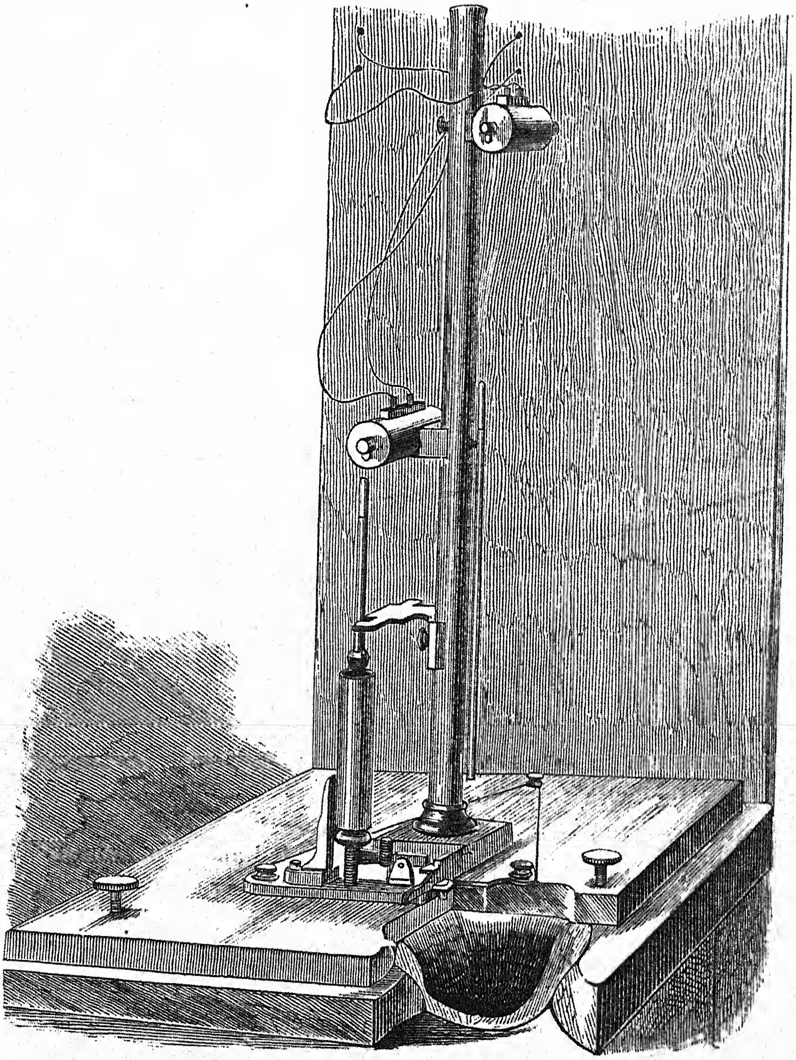


Fig. 302.—Boulénge's Chronograph.

the knife that the velocity is based. Of course, the strength of the currents have to be carefully adjusted, the rod accurately measured, and the calculations worked out to scale; but it is unnecessary to describe the tedious details, though we hope our description, together with the illustration, will convey an idea of the system by which all velocities of cannon, rifles, guns, powders and projectiles are taken.

The following table gives the velocities of the standard English powders:—

Powder.	Arm used.	Velocity. from		to
R F G	Snider rifle	1,250	......	1,290 ft. per second.
R F G 2	Martini Henry ...	1,290	......	1,340 " " "
R L G 2	9-in. cannon	1,390	......	No limit.
Pebble	8-in. cannon	1,420	......	1,480 ft. per second.
Cubical........	38-ton cannon......	1,530	......	No limit.

PROPERTIES OF EXPLOSIVES.

Wood powders possess various advantages over black, the chief being the absence of smoke after the discharge, and the small amount of residue deposited in the barrel. This is on account of the greater per-centage of available gases contained in nitro-compounds to that of gunpowder. Black gunpowders usually give about 65 per cent. solid residue and 35 per cent. available gases, which of course have to drive out of the barrel the solid residue in addition to the charge of shot and wads in front of it; the major portion of the solids being in a state of fine division or smoke. The best wood powder will give about 30 per cent. solid residue, 70 per cent. available gases, consequently one-half the charge of powder by weight is equivalent in force to a full charge of black powder. This leaves, therefore, only about 15 per cent. solid residue to be expelled from the barrel against nearly 65 parts solids from black. The solids resulting from the wood powder are expelled in a coherent form instead of smoke, thus slightly lessening the recoil.

To the great difference in the density of wood and black powder may be traced the disparity between the solid residues of the respective explosives.

Black powder, generally speaking, has a real specific gravity of about

1·720, whilst the Schultze powder, pressed and granulated, has a specific gravity of ·860. Therefore, a charge measuring three drams will weight black powder 84 grains, Schultze 42 grains. In combustion wood powder is far more rapid than black, and therefore a greater muzzle velocity may be obtained with it than with black powder under the same conditions. It seldom gives a greater increase in velocity than 5 per cent., although the makers affirm that it could be made to give more if desired.

In consequence, therefore, of its rapid combustion, it is unfitted for rifles or for very large-bore guns. In small rifles of 360-bore it has been found to answer very well, but black gunpowder is in all cases more suitable where great resistance has to be overcome at the commencement. Schultze powder will not explode if struck between cold iron and copper, two copper, iron and zinc, or two zinc plates, but it will *inflame* if struck smartly between two steel faces, or hot copper plates, or if between two stone slabs with a rubbing motion it will explode; but generally speaking it is only the part coming in immediate contact with the slabs or plates that explodes, the remainder being blown away frequently even not ignited.

Unconfined wood-powder, in common with other nitro-explosives, may be inflamed without obtaining one-half of the available explosive force; to get the best results it must be fired with detonating powder. That usually contained in the ordinary cap of a sporting cartridge-case is sufficient for a sporting charge. By increasing the quantity of detonating mixture in the cap a much more violent explosion results, and to the variation of the amount of fulminate in the caps may be attributed the uncertain results that have frequently arisen whilst using wood-powder. There are few who have used Schultze powder without experiencing occasionally a shock whilst shooting, accompanied by a terrific recoil and a continued buzzing in the ears, as though a double charge of powder had been got into the cartridge case. The most natural thing of course is to blame the powder as being irregular in its action, but in reality it is the cap that is at fault. We have already shown in our article on "Modern Explosives" that the force of all nitro-compounds is greatly increased by firing with detonation, and the greater the quantity of fulminate the greater the force of the explosion, though in all probability some issues of the powder are more susceptible to this variation than others. All issued since 1880 is most carefully purified and toned; we have had no

complaints of any irregularity, and it does not seem so susceptible to the increase of the fulminate. Wood-powder is better with age, for it loses none of its strength, though the combustion becomes slower; neither will damp injure it, for it may be re-dried and allowed to cool, and should be exposed to the air for two or three days. It is best dried by steaming over hot or boiling water, it being perfectly safe to handle any heat up to 300° Fahr., and after drying its qualities will not be found in any way impaired.

In loading the cartridges ramming should never be practiced; all that is required is to push the wad into the case until it rests upon the powder, without compression. Tightly-fitting wads give the best results, but for further directions we must refer the reader to the chapter on Cartridge Loading.

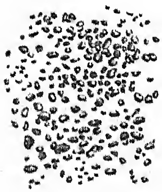


Fig. 303.—Schultze Gunpowder. Fig. 304.—Dittmar Gunpowder. Fig. 305.—E.C. Gunpowder.

Schultze powder, since it was first manufactured in England in 1863, has been greatly improved in its quality. The acids with which it is necessary to impregnate it during manufacture are most carefully expunged by exhaustive and long-continued processes. The deposit in the gun barrel, being alkaline and free from all acid, occasions no detrimental chemical action in the barrel, as has often been affirmed.

The American wood-powder known as the Dittmar is very much similar to the Schultze wood-powder, but instead of being manufactured from pulped ligneous fibre, it is simply prepared sawdust converted into nitro-lignum by treatment with nitric and sulphuric acids. It is not granulated, but resembles sawdust. One quality and grain only is made, which we represent in Fig. 304. The manufacture of this particular powder has been discontinued, but another nitro-compound, like the perfected Schultze, and

known as "American wood-powder," has replaced it. This last powder is superior to the original, but no records of its actual performance at trials has been published.

The granulated Schultze powder is also only made of one quality and uniform strength, which we show, Fig. 303.

The "E. C." powder has many properties in common with the Schultze. Its specific gravity is about the same, the amount of solid residue left in the gun-barrel is, if anything, less; the smoke is less dense even than from Schultze, and the barrels do not heat so rapidly, and, strange to say, invariably heat from the muzzle to the breech, instead of from breech to muzzle, as is usual with black powder. Theoretically, nitro-cellulose is superior to nitro-lignum. In actual practice there is little difference. As a well established explosive the Schultze is known, and the makers profiting by the experience naturally consequent upon continued production, are able to put each and every batch in the market without any appreciable difference in density, strength, and reliability—in short, the Schultze may be said to have established a reputation for regularity.

The "E. C." Company, although doubtless their experiments have been many and their trials full, have not the benefit of long experience of actual results, and there is a marked irregularity in the various batches yet issued. The first or trial lots placed on the market, were remarkable for strength and velocity, and gave excellent patterns with regular and strong shooting. There was a run on the powder, and succeeding issues lacked strength and uniformity. Nevertheless, it may be correctly supposed that the first high standard will yet be maintained. Perfection at once cannot be guaranteed. As results of what is accomplished by the present "weak" issue or issues of powder, will certainly be passed by future batches, we will give as nearer the standard results obtainable, those taken with earlier issues of the powder.

The velocity of the "E. C. Rifle-grain" powder in Martini-Henry Rifle, with service bullet 480 grains, and powder 42 grains, is 1,339·5 feet per second, as compared with 1,320 feet, the average velocity obtained from black powders.

In shot guns 42 grains and $1\frac{1}{8}$ oz. of No. 6 shot in paper cartridge cases, gave an average of 874·52 feet muzzle velocity from a cylinder, 880·14 from a modified choke-bore, and 899·837 feet from a full choke-bored gun, all

guns 12 gauge and within a couple of ounces of 7 lbs. in weight. For patterns in a 30-inch circle at 40 yards, and striking force registered upon the perfected "Field" force gauge. The following series, with same cartridges as for velocities, and from the full choked 12-bore gun, stand unequalled for regularity:—Average patterns, 226, 225, 225, 227, 215, 231, 221, 232, 222, 226, 223; average striking force of the same, 2·13, 2·27, 2·20, 2·09, 2·11, 2·15, 2·09, 2·13, 2·18, 2·10, 2·15, respectively.

The averages were all taken on different dates with same gun. The highest pattern made in the whole series was 248, the lowest 195; the highest force registered 2·50, the lowest 1·97. Could such patterns be always obtainable, and such exceeding regularity guaranteed, the "E. C." powder would stand without a peer.

The recoil in a 12-bore gun of 6 lbs. 10¾ ozs., with 42 grains and 1⅛ ozs., averages 81·4 lbs. The "E. C.," unlike the Schultze, requires a strong ignition to obtain the full energy of the explosion. Nothing but large caps, with wide flash holes, give perfect ignition to this powder, and obviate totally miss and hang-fires. The flash shown in Fig. 208A has been determined the more suitable, whilst the ordinary caps in brass or paper cases are inadequate to overcome the tardy ignition, even though the powder be tightly pressed in the cartridge cases.

Such a cap—or any cap having a larger or stronger charge of fulminate—will detonate with better effect the E. C. powder, yet such a cap is liable to develop a dangerous energy to Schultze powder, a smaller detonation sufficing for this powder than is requisite even for black.

There are a few properties inherent to the various explosives, and demonstrated by laboratory experiments, that have a more or less direct bearing upon gunpowders as applied to sporting arms.

Nitro-cellulose contains about 14 per cent. of nitroxyl (NO_2) when at its full strength; but by using weaker nitric acid in the solution, a less per centage results, and ignition by detonation will be more difficult, combustion slower, and the explosion less violent.

Black gunpowder, on an average, will fire at a temperature of 539° Fahr., whilst nitro-cellulose, or E. C. and Schultze gunpowders, fire at 370° Fahr.

The result of heat before ignition to various explosives is attended by very different results. *Nitro glycerine* will explode with a modicum of violence

when at 60° Fahr., much more strongly at 100° and 350°, and increases in violence up to 750°, but at and beyond 750° it becomes comparatively weak, and its explosiveness is more and more feeble as the temperature is raised.

Black gunpowder is much more violent if heated to 212° before detonating, and the strength of E. C. and Schultze powders increases in a greater ratio than black, and, when heated, requires less detonation.

The strength of nitro compounds generally is better developed when the detonator is in actual contact with the explosive. The flash alone of an explosive cap would not develop nearly so much energy from the powder as would a detonator fired in the middle of the charge; but the explosion would be stronger than if the charge were fired by insertion of a heated wire, or by the application of a flame.

All nitro compounds are more violent in their action the more tightly they are confined, and the stronger the detonation by which they are exploded.

The explosion by means of a Bickford fuse of various explosives in lead cylinders 4×8, and bores 1×4 inches, capacity of 60 cubic centimetres, resulted as follows:—1 oz. of Curtis and Harvey's No. 4 Diamond Grain increased capacity to 280 C. centimetres; whilst ½ oz. of E. C. increased it to 210, and a like charge of Schultze made the same increase.

VELOCITY OF CHOKE-BORE AND CYLINDER GUNS.

In Cannon and Rifles an increase in the velocity of a solid projectile is paramount to a like increase of range and penetration; *ergo*, by registering the *velocity* of a shot gun instead of the *striking force*, we think the much-vexed question of *penetration* might be once and for all put at rest.

The theory that an increased charge of powder would drive shot a greater distance and with more force than a lesser charge, has been held by most gunmakers for many generations, and the penetration test of paper pads has always corroborated the theory; but in 1879 this theory apparently received its overthrow by applying a test for *striking force*, which proved, sufficiently well for the "Field" Gun Trial Committee, that a smaller charge had greater killing power than a large one.

But experiments made with all firearms, from the 100-ton cannon to the ·360 miniature rifle, fully prove that an increased velocity gives greater

penetration; and surely it is the same with shot guns, for shot is subject to exactly the same laws of gravitation, resistance, and projection as bullets; and, accepting this, our experiments prove that an increase of powder means an increase also in velocity, and likewise that Choke-bores give greater velocities than Cylinders.

In our many experiments with Choke-bore guns, we have always been struck with the marked superiority of their penetration compared with Cylinder guns; and, upon the opportunity of testing the relative velocities of the two presenting itself, we gladly availed ourselves of it. The results are as follows:—

A Cylinder Gun making average pattern of 115 at 40 yards, with 3 drs. powder and $1\frac{1}{8}$ oz. of No. 6 chilled shot, registered with $3\frac{1}{4}$ drs. of No. 4 "Alliance" powder and $1\frac{1}{8}$ oz. No. 6 chilled shot, an average muzzle velocity of 798·641 feet per second. *A Choke-bore Gun*, that had been well used for two years, under like conditions and with same charge, registered an average muzzle velocity of 803·001 feet per second, or an increased velocity in the Choke of 4·36 feet per second. The Choke also registered a much more regular velocity than the Cylinder, the highest velocity being 811·016 feet, the lowest 796·575. The Cylinder made no two shots alike, the highest being 825·453 feet; but this was a most extraordinary shot, and helped greatly to raise the average, the next highest being 791·763 feet, whilst the lowest was but 778·509 feet.

With Schultze powder also and different charges, the results in favour of the Choke varied from 15·489 to 33·704 feet per second, proving most conclusively that the Choke gave the most regular and highest velocities.

The charges were most carefully weighed and loaded, but were taken indiscriminately for use in either gun.

Our next experiments were directed to ascertain which charge of powder would give the greatest velocity, and, at the same time, determine if the large charges of powder were burnt in the barrel and beneficial to the shooting, a point that has been well contested in the sporting journals of England and America. The results may be gathered from the following table:—

MUZZLE VELOCITY OF CHOKE-BORE GUNS.

Results.

Charge used.			Highest Velocity.	Lowest Velocity.	Average Velocity.
No.	Powder.	Shot.			
1	3 drs.	$1\frac{1}{8}$ oz. No. 6	797·671 feet.	779·111 feet.	790·171 feet.
2	$3\frac{1}{4}$,,	$1\frac{1}{8}$,, ,, 6	811·016 ,,	796·575 ,,	803·001 ,,
3	$3\frac{1}{2}$,,	$1\frac{1}{8}$,, ,, 6	849·519 ,,	830·605 ,,	842·171 ,,
4	4 ,,	$1\frac{1}{8}$,, ,, 6	892·111 ,,	868·773 ,,	880·442 ,,
5	$3\frac{1}{4}$,,	$1\frac{1}{8}$,, ,, 4	866·368 ,,	837·686 ,,	852·752 ,,
*6	$3\frac{3}{4}$,,	$1\frac{1}{8}$,, ,, 4	883·210 ,,	849·519 ,,	871·178 ,,
7	$3\frac{1}{4}$,,	$1\frac{1}{8}$,, ,, 1	911·210 ,,	873·256 ,,	890·830 ,,
*8	$3\frac{3}{4}$,,	$1\frac{1}{8}$,, ,, 1	897·651 ,,	888·026 ,,	892·596 ,,

* Shots No. 6 and 8 were fired from brass cartridge-cases.

The whole series of experiments were made with an ordinary Choke-bore gun, 12 gauge, $7\frac{1}{4}$ lbs., 30-in. barrels, that had been used continually for two years; with a new gun, and heavier barrels, doubtless it would be an easy matter to exceed the above velocities. They are not published as a criterion of our work, for future experimentalists to boast of having beaten, but merely as a basis to show how an increase of powder, and the use of larger shot, respectively affect the velocity.

Chilled shot and No. 4 Alliance powder were in all cases used, with grease-proof thick felt and cardboard wads over powder, and thin cardboard over shot. The brass cases were used for the larger charges, as the $2\frac{3}{4}$-in. paper metal-lined case would not conveniently contain them.

From the above table it will be seen that with No. 6 shot a greater increase in velocity is obtained by increasing the charge from $3\frac{1}{4}$ to $3\frac{1}{2}$ drachms than from 3 to $3\frac{1}{4}$, or from $3\frac{1}{2}$ to 4; that is to say, that in reality $3\frac{1}{2}$ drachms of powder gave the best results, consequently we are led to the belief that more than $3\frac{1}{2}$ drachms of powder is not properly burnt in a 12-bore barrel with $1\frac{1}{8}$-oz. shot. With the larger shot it will be noticed that a correspondingly higher velocity was attained. For instance, with No. 4 shot and $3\frac{1}{4}$ drachms, 852·752; compared with 803·001 with a like charge of No. 6 shot.

With No. 1 shot the difference is even more marked, the No. 1 shot with $3\frac{1}{4}$ drachms registering a higher velocity by 87·829 ft. per second than the same charge of No. 6 shot.

Apparently a less charge of powder is required when firing large shot. The extra half drachm with the No. 1 shot increased the velocity by 1·766 ft.; with the No. 4, 18·426 ft.; but with the No. 6, 52 ft. The conclusions are obvious.

A heavier 12-bore gun, constructed specially for wild-fowl shooting, made, with 3½ drachms, and 1¼ oz. of No. 6 shot, an average velocity of 781 ft. per second; with same charge, but No. 4 shot, 810 ft.; with 1½ oz. No. 1 shot, and 4¼ drachms of powder, 954 ft.; with same charge, but No. 5 shot, 884 ft. per second. All the shots were from brass cartridge-cases, with usual wads, and No. 4 powder.

Our next steps were taken to ascertain the relative velocities of guns of different bores with proportionate charges.

The guns were all of usual weights, and paper cartridge-cases used in the 20- and 16-bores, and brass in the 10- and 8-bores.

The results were as follows:—

20-BORE GUN, with 2¼ drachms and 1 oz. No. 6 shot, average velocity, 725 ft.; with same charge, but No. 5 shot, average velocity, 738·8 ft. per second.

16-BORE GUN, with 2½ drachms, and 1 oz. No. 6 shot, average velocity, 780 ft.; with same charge, but No. 5 shot, 791 ft.

12-BORE GUN, with 3½ drachms and 1⅛ oz. No. 6 shot, average velocity, 842·171 ft.

10-BORE GUN, with 4½ drachms and 1½ oz. No. 6 shot, average velocity, 890 ft.; with same charge, but No. 4 shot, 936 ft.; with 1½ oz. No. 1 shot, and 3 drachms of powder, 943 ft.

8-BORE GUN, with 6 drachms of powder, paper case, and 2¼ oz. No. 1 shot, average velocity, 907 ft.; with 7 drachms No. 4 powder and 2¼ oz. No. 1 shot, and brass case, average velocity 984 ft.; with same load, but finer-grained powder, 945 ft.; with same load, but with ducking powder, *expressly manufactured for* 8- *and* 4-*bore duck guns*, average velocity *only* 904 ft.

[For other charges see preceding table.]

It will be seen that the 12-bore gives proportionately the highest velocity; that is to say, the 12-bore gives a more than relatively higher velocity than the 16-bore, for whilst the 16-bore possesses a better velocity over the 20-bore than the 10-bore does over the 12-, or the 8-bore over the 10-, the relative proportion of the 12-bore over the 16-bore is much higher, and with the large shot the difference is still more marked.

A study of these remarks and tables proves that the 16-bore is better than the 20-bore with all sizes of shot, but that the 12-bore gives

undoubtedly the best all-round velocities. The 10-bore is but slightly higher, and the 8- exceeds the 10- by only a few feet, especially with the No. 4 shot.

A striking peculiarity is to be found in the shooting of the 8-bore. The special powder manufactured expressly for it by one of England's best makers proved inferior in velocity to the ordinary gunpowder that we have for the last four or five years advocated, although our convictions were only based upon the patterns made and the penetration of paper pads.

Our theory is that the charge used in the 8-bore is so large that it requires a powder of comparatively small grain to be entirely consumed; and that, therefore, a slower-burning powder, when used in so large a charge, has not time to fully develop its strength before reaching the muzzle.

THE BURSTING STRAIN OF GUN BARRELS.

In 1858, the late W. Greener stated the strength of a laminated steel barrel, 3-16ths of an inch thick, to be equal to a strain of 6,022 lbs., and that, providing the tube be filled with powder for 1-in. in length, and 1 oz. of shot, the explosive force will be equal to 40,000 lbs., or 1,700 lbs. to the inch; if $1\frac{1}{2}$ oz. of shot, 2,550 lbs.; and if 2 ozs. shot, 3,400 lbs. How he

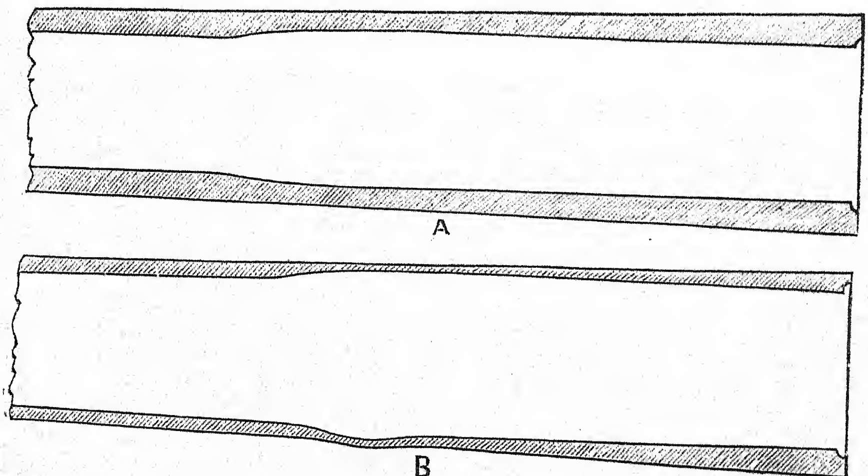
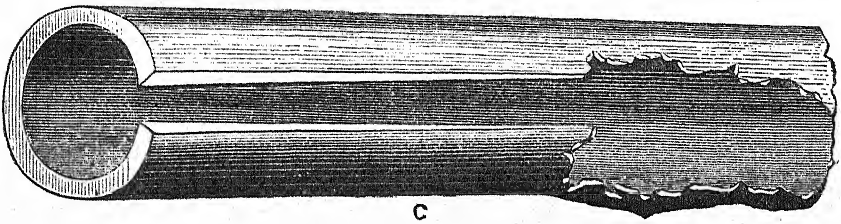


Fig. 306.—Sections of Breech-end of Gun Barrels.

obtained these figures we cannot say, but recently we have made experiments to test the different portions of gun barrels. We show in Fig. 306 a section of the breech-end of the barrel of an ordinary double 7-lb. 12-gauge gun, showing exact size and shape of cartridge-chamber, and thickness of metal. The thinnest part is at the commencement of the cone, at the extremity of the cartridge-chamber, and it is here also that the greatest strain of the explosion is exerted, and where all guns first bulge, if a strong explosive or a large charge is used; but to prove that even at this point there is sufficient metal to ensure safety with ordinary heavy charges, we reduced a 12-guage barrel until it presented the appearance of B (Fig. 306), the metal at the *weakest* point being but ·05 in. thick. It bulged slightly after repeated firing with $3\frac{1}{4}$ drs. of best Alliance No. 4



C

D

Fig. 307.—Section of Fore-end of Gun Barrel.

powder, and $1\frac{1}{4}$ oz. shot. An exact representation of the bulge is given in B (Fig. 306).

At 6 in. from the breech the barrel was but 1-48th in. thick, and there was no sign of any bulging.

Another barrel thicker at the breech, but the same thickness (1-48th in.) 6 in. from the breech-end, we burst with a charge of 42 grs. Schultze powder, and $1\frac{1}{8}$ oz. shot, the barrel presenting the appearance of Fig. 307 C. At a distance of 18 or 20 in. from the breech, there is very little strain. The thickness indicated by the line D (Fig. 307) is the exact thickness of a 12-bore gun barrel from 17 to 25 in. from the breech, and which was not in any way bulged or injured by repeated firing of the usual charge, the barrel remaining intact until ripped up with an ordinary penknife without any trouble. A transverse cut in this portion of the barrel does not appear

to dangerously weaken it. We cross-slit a barrel sufficiently to pass a threepenny bit, and fired it with usual charge, without appreciably opening the slit or bulging the barrel.

As we have before mentioned, the weakest part of a barrel is at the cone of the chamber, caused by the great reduction in the thickness of the metal there. According to some natural law, minerals, but especially iron and steel, are more prone to break where a reduction in the thickness occurs. For instance, take a rod of steel gradually tapering from 1-in. to $\frac{1}{4}$-in. in thickness, make an incision near the thicker extremity, reducing the rod to $\frac{3}{4}$-in. thick, and it will more readily break there than at any other part of the rod; if the incision be but 1-16th deep, but extends completely round the rod, it will still break at the incision, and even much more readily than before. Yet even lately it has been argued by scientific theorists that the cone of the chamber should be made more sudden, or even a square shoulder left, against which the end of the cartridge-case may bed. To all who still hold these opinions we would say, that shortly after the introduction of breech-loaders it was tried and abandoned. The cartridge-cases were not, and cannot be, made to such a nicety that they will bear evenly against the bottom of the chamber, so that the very object for which the square shoulder was left was not obtained, and the shape of the chamber weakened the barrel very considerably; and, as it is impossible to remove all residue from a square-shouldered chamber, the acids quickly eat into the metal *there*—at the weakest part—rendering the gun in a short time dangerous.

Behind the cone, the barrels, as now constructed, are sufficiently strong for all purposes. We have made a longitudinal incision in a barrel, extending half the length of the cartridge-chamber, and a transverse slit severing $\frac{1}{3}$ of the circumference, the two incisions forming a T on one side of the cartridge-chamber. With ordinary charges these slits were not appreciably opened, but with 50 grs. Schultze and $1\frac{1}{8}$ oz. shot, the longitudinal slit widened ·08 in., the transverse ·045 in.

From this we learn that when light guns are required, they must be constructed much lighter at the breech-end, but quite as strong, if not stronger, at the cone of the cartridge-chamber. This is, doubtless, the scientific method of constructing extra light weapons, and it is the one we practice; but it destroys the gradual taper and symmetrical sweep of the barrel.

Ordinary guns may be said to be more than sufficiently strong for ordinary charges, and except just at the cone in the chamber there is but little strain on a cylinder barrel, unless Schultze powder be used. Our experiments fully prove that the Schultze gunpowder exerts a far greater strain upon the breech-end of the barrel than does an equal charge of black.

A good barrel we should warrant *safe* to shoot with ordinary charge, after a slit had been cut half though the barrel anywhere, except, perhaps, just at the chamber cone. Sportsmen, therefore, need not fear an accident on the appearance of a little honeycomb in a gun barrel. It will usually stand being bored out many times before in the least affecting the *safety* of the gun.

Of course these remarks are only applicable to the English-made barrels of best quality. Belgian barrels would probably not bear half the strain.

In choke-bored barrels, too, there is a considerable strain upon the muzzle, varying according to the amount of choke; the barrels consequently have to be left thicker near the cone. Best cylinder barrels might be left as thin as writing-paper at the muzzles, yet be perfectly safe.

In the smaller bore guns, we find the strain at the breech-ends greatly increased, indeed, so much so, that we would recommend sportsmen to have only the very best metal in 20-bore barrels, and, consequently, have ceased to make our cheapest guns of any smaller bore than 16-.

It has always been taken as an axiom, that if the muzzle of a gun barrel be by any means plugged up with dirt, snow, or other matter, and the gun then fired, the barrel will burst. It has also been repeatedly asserted that a wad slipping a few inches down the barrel, or left from a preceding charge, would burst the barrel should it be fired before the impediment was removed.

We have experimented to prove these assertions, and find them far from being true.

Taking a light double breech-loader, with a very thin but sound barrel, we placed a felt wad, $\frac{3}{8}$ in. thick, six inches from the breech, and fired with ordinary cartridge. The wad was blown out, the barrel remaining *uninjured*. We next placed a wad at 12, 24, 28 and 30 in. successively, with the same result. The experiment we several times repeated in different guns, the

wad at last being placed level with the muzzle, but, to our surprise, the barrel remained uninjured.

We next plugged the muzzle with stiff mud for the distance of one inch; this resulted in one inch being blown off the muzzle. We afterward placed a plug of pulped paper two inches from the muzzle, and a concentrator midway in the barrel, but no bulging or bursting resulted.

Now we are willing to own that we have attributed several burst barrels to wads slipping and muzzles becoming plugged up, but we shall be less liable to state these as causes in future.

Barrels do sometimes burst in the most unaccountable manner, but from these experiments it appears that wads slipping *will not* cause them to do so as a rule, and plugged muzzles are not always attended with disastrous or dangerous results.

The following is cut from a newspaper of 6th November, 1883:—

"Our readers will be glad to learn that Lord de Vesci, who recently lost his second and third fingers by the bursting of a rifle while he was deer-stalking in the Highlands, is progressing most satisfactorily. It seems the rifle was loaded in the morning, and it was not discharged till late in the afternoon. In the meantime it was carried with the muzzle pointed towards the ground, and the bullet slipping from the breech, a space of about an inch and a-half was left between the charge of powder and the projectile. When the rifle burst the stock was hurled over Lord de Vesci's shoulder, and the pieces of the barrel also flew behind him."

It would be rash to state that the burst was due to the position of the bullet. Yet the matter is a critical one to decide upon. It is a fact that many steel and twist rifle barrels have been tested with the bullet or projectile at varying distances from the charge, permitting an air-space, and when fired, even with large charges, no burst has occurred. It is common in Germany and Scandinavia to employ Express rifles, with the long taper case. To shoot roe-deer or small game with such a rifle would spoil the flesh, and be a great waste, so, ordinarily, but two to three drams of powder is used, the bullet stuck as usual in the end of the case, the powder shaking about loose in the cartridge. No burst barrels are recorded from this practice, and the author has fired a rifle so loaded, and never noticed anything except a slight increase in the recoil, the shooting being just as accurate, although, of course, without the velocity and long point-blank range of the Express.

As a test of what steel rifle barrels will stand, we put to the proof

a solid-drawn drilled ·500 barrel of very best Siemen's steel, acknowledged to be most suitable for rifle barrels, and also tried one of our weldless solid twist barrels of same weight, bore, size, and length. Both stood perfectly 30 drs. of Government powder and one lead cylinder of 715 grs. weight; with 30 drs. and two cylinders the steel barrel bulged, the solid twist betrayed no weakness; with same charge and three lead cylinders the steel barrel broke, and the twist was slightly bulged, and it burst with 30 drs. and four lead cylinders—equal to four provisional proofs.

Steel is better than an ordinary twist barrel for rifling, since the grooves may be cut cleaner, but the solid weldless presents an equally smooth even surface for rifling.

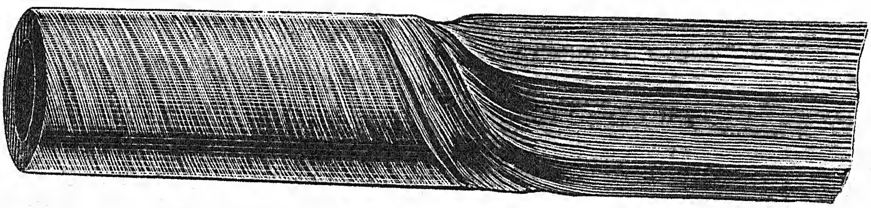


Fig. 308.—Greener's Solid Weldless Twist Rifle Barrel.

Steel of any quality, the mildest or hardest, is very subject to variation of temperature. A rod of 1-in. steel, such as is used for rifle barrels, and supposed to be of the toughest, may be handled, and afterwards hammered cold to almost any shape without breaking; but expose the same piece to the action of the frost on a cold frosty night, and the next morning it may be snapped off on the anvil as though it were glass rod, not a piece of "toughest steel."

The annexed illustration shews method of making the solid weldless twist barrel from ordinary gun barrel iron. The twisting closes the grain of iron, making it more dense towards its centre, thus presenting an even solid surface for rifling; whilst outside the grain of the iron runs spirally from one end of the barrel to the other, and has the appearance of a twist barrel.

MISCELLANEA.

PUNT GUNS.

COL. HAWKER, the great authority on punting, has given the most minute details of this sport in the eleven editions of his "Instructions to Young Sportsmen." Being an enthusiastic sportsman, he endeavoured to improve the guns and addenda necessary for wildfowling, and modern fowlers owe much to his energy in promoting the interests of the sportsmen who were the first to indulge in this sport as a pastime.

His remarks are confined to Muzzle-loading Guns, and are so complete that it would be presumptuous to offer anything further respecting them.

We shall therefore confine our remarks to Breech-loading Punt Guns, as, although muzzle-loaders are even now chiefly used by those who shoot solely for the market, very few gentlemen will be troubled with them owing to the great difficulty experienced in loading them.

They cannot be loaded without running to land and getting out of the punt; even then it is an unpleasant and by no means easy operation to accomplish satisfactorily, the charge of powder having to be measured into a scoop affixed to a rod, which is passed down the barrel, then turned over, shaken, and withdrawn; the wadding and shot cartridge have to be subsequently inserted and rammed home.

For breech-loading Punt guns many systems have been and are still employed. The great difficulty has been to obtain a thoroughly reliable cartridge-case that will always extract easily. Steel breech-chambers have been tried, and cases made from brass tube with bases and cap-chambers brazed or soldered in, but all have proved defective, and, after once firing, have been so bulged as not to enter the chamber again, or else have failed to extract; the ignition also was far from perfect.

In the breech-actions a variety of mechanisms are in use; some have a screwed-in breech-plug, and the Snider breech-action is still with some

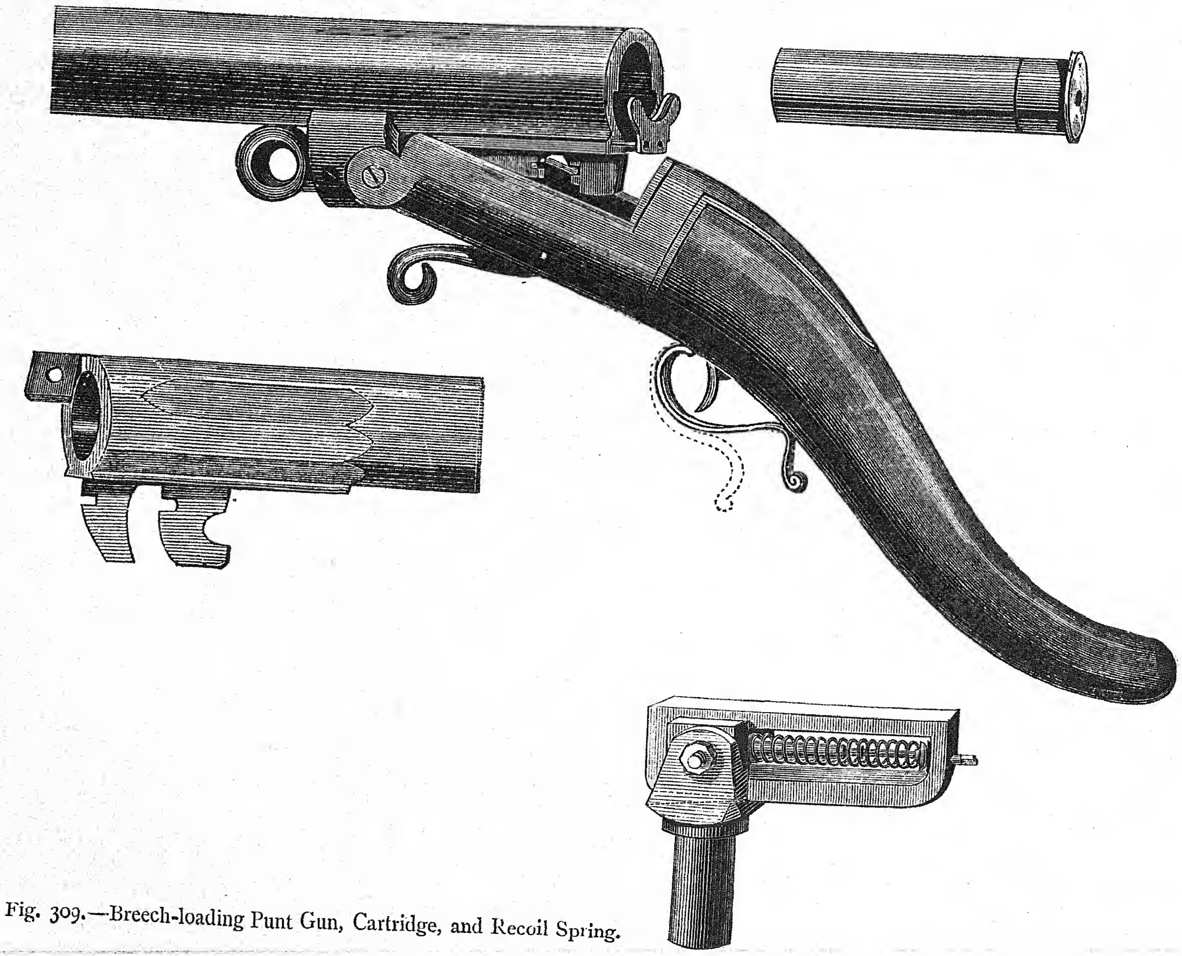


Fig. 309.—Breech-loading Punt Gun, Cartridge, and Recoil Spring.

makers a favourite for Punt guns. There are several modifications of the drop-down system likewise used. One we illustrate in Fig. 309.

This Punt gun has only the fastening upon the lump underneath the barrel, which is similar to the double-grip fastening so common on small sporting guns. The stock is old-fashioned, being far too long, and made to go underneath the arm or chest, the intention being for the shooter to sustain a portion of the recoil; there is a short fore-end with ring for rope-breeching, the gun is hammerless, the lock being cocked by depressing the trigger-guard.

The cartridge-case, which is of cardboard with metal base and central-fire, we show in Fig. 309. It was considered efficient at first, but has been superseded by the solid-drawn brass case, which extracts better, loads more times, and is not affected by damp.

The "London" Punt gun, made by Messrs. Holland, in the Metropolis, is shown in Fig. 310. They are made of various sizes to order, but the usual bore is of 1½-inch, and weight 100 lbs.; the barrel is of Siemen's steel, and drilled from the solid. The breech-action is constructed upon a sound principle; the breech block and extractor—shown detached 7—are, together with the cartridge 8, pushed into the chamber of the barrel, the two wedge-bolts 2·2 go upward through two half slots in the breech-block 7, and firmly bolt it into the barrel. The stock covers the breech end of the barrel, but does not have to stand any of the strain of the explosion. The breech-block and cartridge are extracted together by simply pulling, or, if necessary, by twisting the loop-handle 3·3, a powerful screw brings out the case for about half an inch, and thus relieved, it may be easily withdrawn. The action-lever 4, by turning the quarter of a circle, keeps the stock and wedge-bolts up in position for firing.

We some time ago saw that before any perfect Punt gun could be made it would be necessary to have a better cartridge-case, so, at a considerable expense, we prevailed upon a Birmingham Cartridge Manufacturing Company to produce a *solid brass-drawn* cartridge-case, one and a half inches in diameter, to contain *three ounces* powder and one and a half pounds shot, the length over all being but *seven* inches. The cap and anvil are in one, the latter having a leg projecting through the dome of the cap-chamber into the cartridge-case, so that a rammer is all that is required to de- and re-cap the cases. The wadding for breech-loading Punt guns

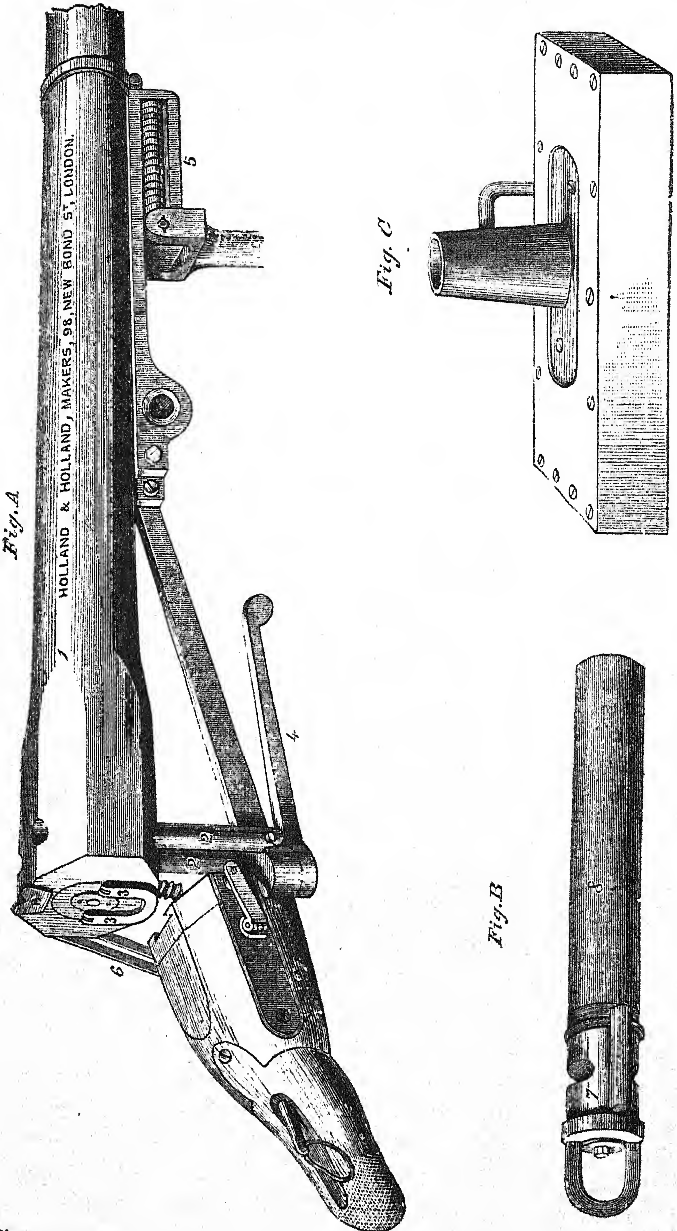


Fig. 310.—The London Punt Gun, and Mr. E. T. Booth's Recoil Box.

should be felt 1-in. thick, and three strong cardboard wads between powder and shot, and cardboard over shot. This wadding is far superior to the oakum packing often used.

These cartridge-cases, in one of our special wedge-fast Punt guns, will be found to possess almost everlasting wear, as we have already explained it is the peculiarity of solid brass-drawn cases to expand and retract, enabling them to be easily removed and inserted many times. The leading feature of our wedge-fast Punt gun is the top connection between the barrel and the breech-action, in addition to the usual double-grip fastening underneath the barrel. The top bolt is worked by a small winch handle on the right-hand side of the breech-action; the bolts thus work independent of each other and are sufficiently quick for Punt guns, great speed in loading not being essential. This screw-bolt is shown at A, Fig. 311.

The great advantage of the top fastening for shoulder guns of all kinds has already been demonstrated, and it is the same with Punt guns. A good fastening at the top, whilst handy and very strong, prevents the breech-action from wearing loose, and the cartridge from bursting at the rim during the discharge. As will be seen from Fig. 311, the gun is hammerless, being cocked by depressing a hand-lever on the side of the lock-plate. The lock is back-action upon the rebounding principle, the tumbler being elongated, and striking a horizontal sliding plunger, working in the face of the breech-action and firing the cap in the cartridge-case.

Another great advantage is the method of making the breech-action and stock fast to the barrel without the aid of a fore-end; this allows of the stock being unshipped easily, and makes a slight difference to the weight also.

The stock, it will be seen, is unlike that shown in Fig. 308, it being intended as a handle only, to aim the gun, the whole of the recoil being sustained by the Manilla breeching.

Punt guns built on this principle, and taking both brass and paper cartridges, are in constant use, have been subjected to every weather the last few seasons, and have never "stuck fast" or failed in any way.

Another breech-loading Punt gun is formed by screwing a breech-action on to a Punt gun barrel. The best action for this purpose is the Field, which makes a very handy Punt gun. We show this gun in

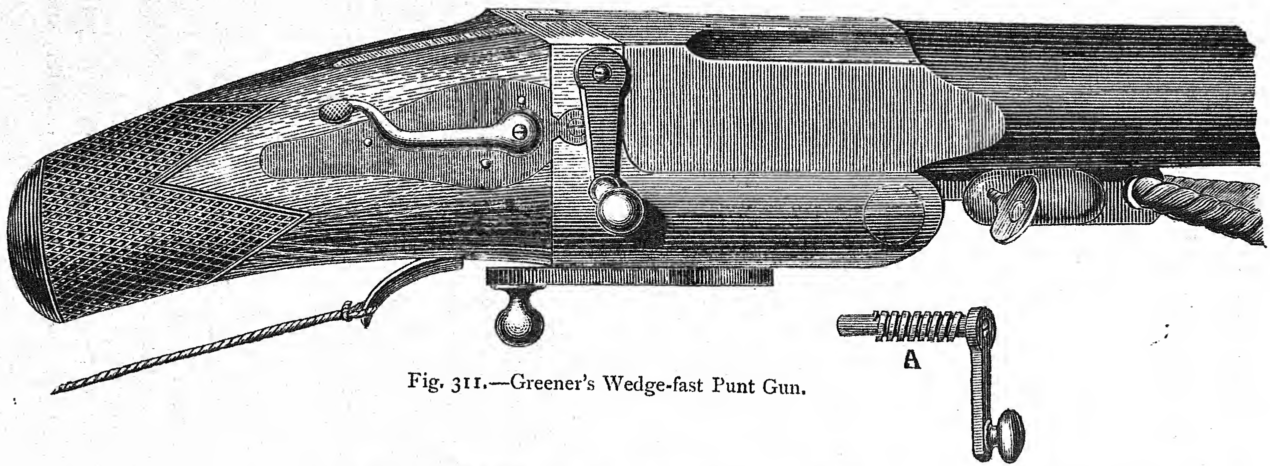


Fig. 311.—Greener's Wedge-fast Punt Gun.

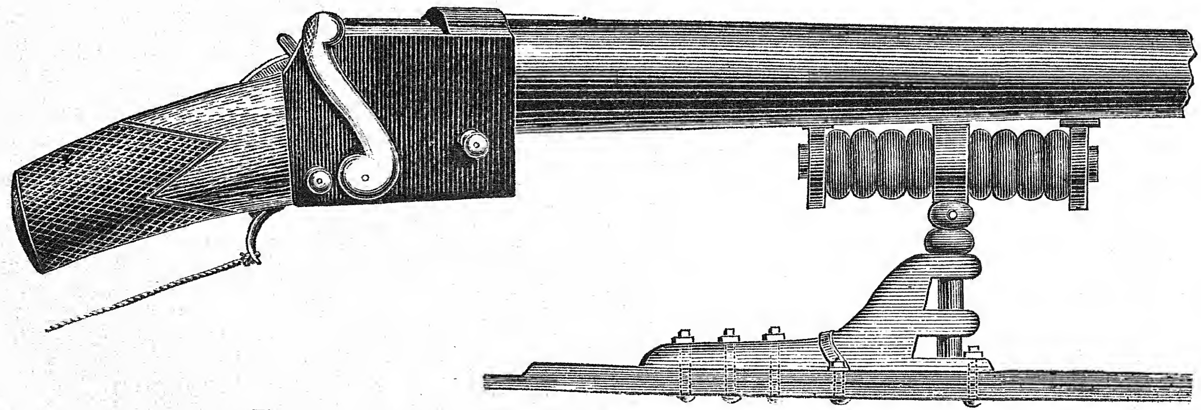


Fig. 312.—Greener-Field Punt Gun, with India-rubber Recoil-breeching.'

Fig. 312, with "Wildfowler's" india-rubber recoil-breeching affixed. The mechanism is shown in Fig. 128.

The advantage of having a falling breech-block is, that the punt being very shallow, unless the gun is raised by crutches, there is not sufficient room for a breech-action and stock to drop, but with a falling breech-block the gun can be got lower on the punt, and yet there will be plenty of room to manipulate the gun.

Of the several plans produced to sustain the recoil of Punt guns, none is more in favour than the manilla rope-breeching. This consists of a good piece of manilla rope passed through an eye or toggle attached to the gun-barrel, and round the stem of the punt. The rope is usually spliced to form a loop, which is slipped over the stem when the gun is in position on the punt.

Col. Hawker's coil-spring breeching, Fig. 309, is also considerably used, whilst the latest improvement is the india-rubber breeching shown attached to the Greener-Field Punt Gun in Fig. 312, or Greener's Toggle.

Mr. E. T. Booth's recoil-box, in which the swivel is checked by rubber buffers fast to bitts through the deck of punt, sometimes assisted also by rope breeching is shown in Fig. 310 at *c*.

Punt guns usually lie on one or more crutches on the fore-deck of the punt, as illustrated in "Punting." Many plans have been tried to render the aiming of a punt gun more easy. The best are by an adjustable crutch sliding along the deck of the punt; or by a hand-lever raising the crutch itself. Guns with spring or india-rubber buffers are pivoted on to a swivel (Fig. 312), and have only one crutch near the muzzle. Those with rope-breeching lie in another crutch, within easy reach of the shooter, and this crutch is sometimes raised with a screw to give the elevation, but it is too slow in its action, and is not recommended.

The bore of Punt guns is usually $1\frac{1}{2}$ in. in diameter, the barrel being 8-ft. long, and firing $2\frac{3}{4}$ oz. of punting powder, and from 16 to 22 or 26 oz. of shot (usual sizes are from 1 to S.S.G.). Such a gun, upon the model of Fig. 309, will weigh 130-lbs.; if like Figs. 311, 312, the weight will not exceed 100-lbs., without crutches or recoil apparatus.

A smaller gun is sometimes made of $1\frac{1}{4}$ in. bore, barrel from 6- to 7-ft. long, weighing about 80-lbs. Such a gun will fire $1\frac{1}{2}$ to 2 oz. powder, and from 14 to 18 oz. of shot.

Punt guns are made single-barrel, double guns having so many disadvantages on account of the weight, and requiring a larger and more cumbersome punt.

HARPOON GUNS.

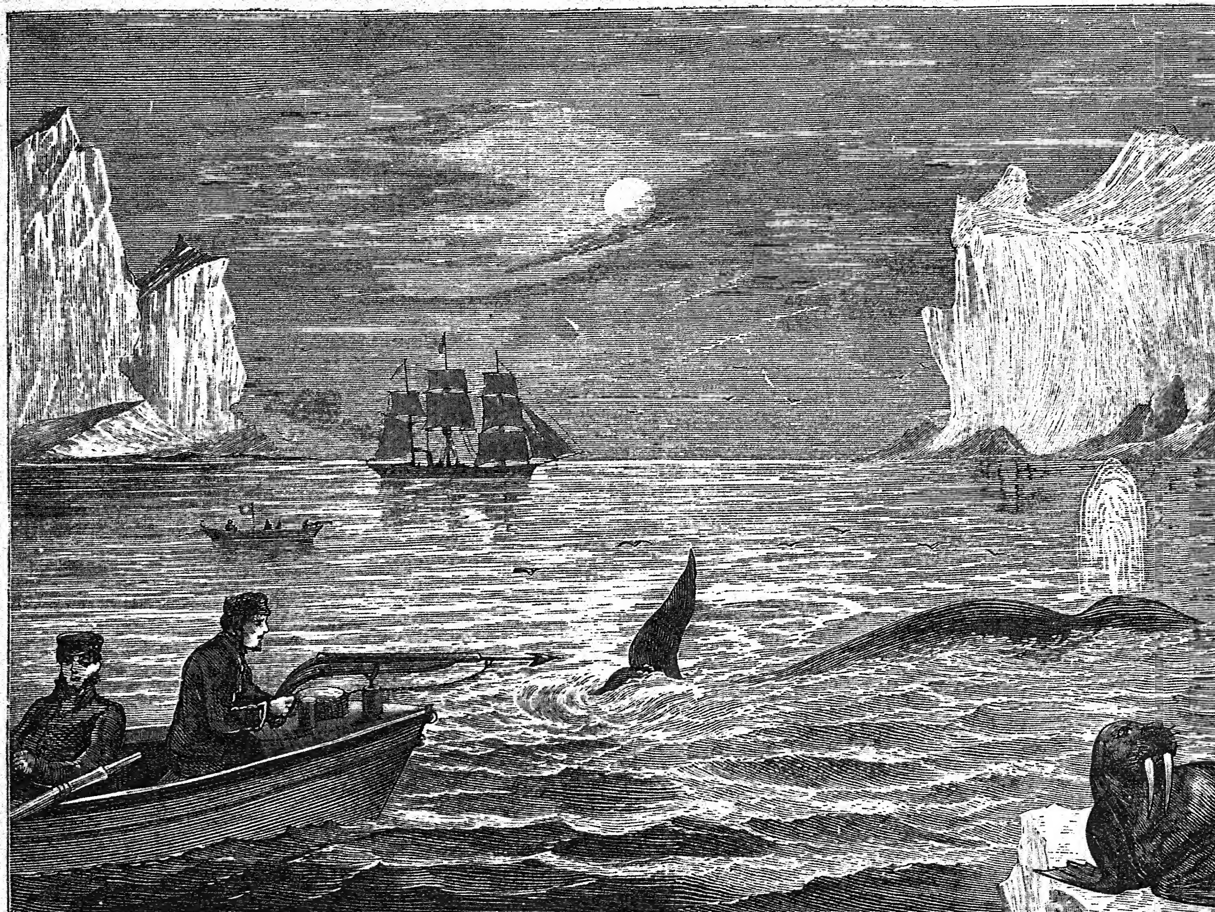
These weapons were invented for the purpose of rendering whale fishing a less dangerous calling; and as a greater range was obtained than could ever be got from the hand harpoon, the guns have been instrumental in making larger catches, and are now carried by all the Scotch whalers. The South Sea whalers no longer fit out from London, and the trade has of late years been almost solely in the hands of the Americans.

The harpoon gun is similar to a small swivel gun. It has a stock of ash or wych elm, well bent down to form a handle with which to aim it. The whole of the recoil, which is considerable, is sustained by a strong swivel pinned to the stock and barrel. The barrel is $1\frac{1}{2}$-in. bore, the lock simple, being similar to that of a saddle pistol. The caps, nipples, hammer and lock are securely protected from sea-spray or blows by a brass cover. The lock is securely bolted until a pin is removed, when the gun can be fired by pulling a cord attached to the trigger. The length of the barrel is 3-ft., and the weight of the gun complete about 75-lbs. The harpoon weighs about 10 lbs. with shackle, and is fired with a 1-inch line—"fore-goer"—attached. This rope is of manilla, and forty yards in length, after which hemp-line is laid on, the forty yards being considered the outside range for firing.

Captain J. B. Walker, of Dundee, kindly furnished us with a sketch of his ship, the S.S. "Erik," and boats whaling. The truthfulness of the sketch has been commended by other whaling captains; and, unlike the many exaggerated illustrations that have appeared from time to time in various periodicals, this may be relied upon as portraying whaling ground and ordinary appearance of right whale before being struck.

Steel barrels have been mooted as very suitable for harpoon guns, but the intense cold of the latitudes in which such guns are used would probably render the steel brittle, and burst barrels result.

The harpoons are of best charcoal iron, the Peterhead whalers preferring the barbs to lie vertically, and so to fly as to strike the whale so $>$, whilst



Whale Shooting with Harpoon Gun.

the Dundee and Norwegian whalers insist upon the harpoon flying with the barbs horizontally.

The American bomb explosive shell is used for *killing* whales when made fast with a harpoon. It is fired from a brass gun of about 30 lbs. weight, weighs a little over half a pound, is one inch in diameter, projected with a charge of one dram, and is shown in Fig. 313. Whales are also killed by thrusts with long hand-lances.

Fig. 313.—Explosive Shell for Whale-Shooting.

The Americans, and some Norwegians, in lieu of harpoon-guns, take small mortars, firing the barbed or winged lance shown in Fig. 314, which is to explode when in the whale by tugging, the "flyers" or barbs having their shorter ends in the lance over a fulminate cap on a nipple communicating with the charge.

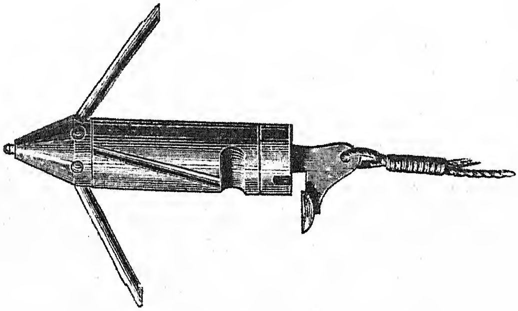


Fig. 314.—Explosive Bomb-Lance.

A lance-harpoon, with explosive base, the invention of the manager of the Tay Whale Fishing Company, to fire from the harpoon-gun has also been tried with success. The liability to accident from the promiscuous use of explosive projectiles is a deterrent to their more general adoption in this industry.

THIN BRASS CARTRIDGE CASES FOR SHOT-GUNS.

The results of many experiments made by ourselves and other disinterested persons with guns of various bores made specially for the "Perfect" thin brass cases are convincing. The Perfect cases are advantageous. The extent to which the several advantages will advance can at present only be guessed at, but the improvement is such as to bring up the shooting of guns to those paper-case guns having bores two or four sizes larger. The pellets of the charge are propelled with greater force, in better shape, and more closely together than from paper-case guns, so that not only is the penetration and velocity greater, but from five to ten per cent. more of the pellets reach the target aimed at, and arrive simultaneously, not straggling up in successive batches. In short, a 12-bore brass-case gun weighing only $7\frac{1}{4}$ lbs. is superior to a 10-bore paper-case gun weighing $9\frac{1}{2}$ lbs.

The following tables, results obtained from our guns, are taken from the *Field* :—

October 21st, 1882.

Shooting of 12-bore Gun, Perfect Cases, 4 drms. Black Powder, and $1\frac{1}{4}$ oz. No. 5 Chilled Shot, at 40 yards.

	On Gauge.	Force.	Pattern on 30-in.
	55	3·00	217
	41	2·88	200
	53	3·09	212
	49	2·98	206
	44	3·00	197
	41	2·98	200
Average	47	2·98	205
Highest	55	3·09	217
Lowest	41	2·88	200

Figure of Merit, 503.

$3\frac{1}{2}$ drms. Black Powder, and $1\frac{1}{4}$ oz. No. 5 Shot, Perfect Case.

	On Gauge.	Force.	Pattern on 30-in.
	45	2·56	206
	49	2·92	207
	62	3·43	214
	50	2·88	209
	63	3·53	218
	54	2·85	216
Average	53	3·02	211
Highest	63	3·53	218
Lowest	45	2·56	206

Figure of Merit, 513.

4 drms. Black Powder, and $1\frac{1}{4}$ oz. No. 6 Shot, Perfect Case.

	On Gauge.	Force.	Pattern on 30-in.
	74	2·37	275
	63	2·63	260
	75	2·40	277
	71	2·47	272
	60	2·33	262
	66	2·56	268
Average	68	2·46	269
Highest	75	2·63	277
Lowest	60	2·33	260

Figure of Merit, 515.

3½ drms. Black Powder, and 1¼ oz. No. 6 Shot, Perfect Case.

	On Gauge.		Force.		Pattern on 30-in.
	64	...	2·27	...	269
	54	...	2·13	...	260
	71	...	2·53	...	273
	65	...	2·23	...	259
	68	...	2·25	...	270
	66	...	2·54	...	272
Average	65	...	2·32	...	267
Highest	71	...	2·54	...	273
Lowest	54	...	2·13	...	259

Figure of Merit, 499.

July 8th, 1882.

With 4 drms. Black Powder and 1¼ oz. No 6, at 40 yards.

	Index.		Pattern on 10-in.		Force.		Pattern on 30-in.
	192	...	73	...	2·63	...	270
	174	...	64	...	2·71	...	285
	213	...	80	...	2·66	...	304
	192	...	73	...	2·63	...	294
	170	...	65	...	2·61	...	278
	167	...	61	...	2·73	...	263
Average		...	71	...	266·16	...	282·33

Figure of Merit, 548·49.

Same Gun and Charge at 45 yards.

	Index.		Pattern on 10-in.		Force.		Pattern on. 30-in.
	154	...	69	...	2·23	...	252
	128	...	53	...	2·42	...	241
	100	...	46	...	2·17	...	238
Average		...	56	...	227·33	...	243·66

Figure of Merit, 470·99.

Shooting of Pigeon Gun at 40 yards, with 3½ drms. 5 grs. Black Powder, and 1⅛ oz. No. 6 Shot, Field Trial Size.

	On Gauge.		Force.		Pattern on 30-in.
	42	...	2·88	...	243
	54	...	2·62	...	245
	65	...	2·53	...	236
	69	...	2·66	...	251
	60	...	2·55	...	238
	73	...	2·49	...	236
	30	...	2·00	...	155
	52	...	2·46	...	236
	42	...	2·21	...	221
	63	...	2·69	...	239
	43	...	2·16	...	168
	55	...	2·36	...	213
	72	...	2·89	...	244
	57	...	2·54	...	207
	52	...	2·59	...	244
Average	55·26	...	2·49	...	224
Highest	73	...	2·88	...	251
Lowest	30	...	2·00	...	155

Figure of Merit, 473.

For comparison with above are appended scores made with Dr. Carver's Full-choke Gun :—

July 1st, 1882.

Dr. Carver's Gun, 3-in. Paper Case, 4 drms. Black Powder, and 1¼ oz. No. 6 Chilled Shot, 270 to oz, at 40 yards.

	Index.		Pattern on 10-in.		Force.		Pattern on 30-in.
	147	...	59	...	2·49	...	253
	113	...	48	...	2·35	...	244
	119	...	54	...	2·21	...	232
	175	...	68	...	2·57	...	270
	128	...	54	...	2·37	...	232
	67	...	32	...	2·07	...	197
Average		...	52·5	...	234·66	...	238

Figure of Merit, 472.

At 45 yards.

Index.	Pattern on 10-in.	Force.	Pattern on 30-in.
92	46	2·00	194
94	47	2·00	194
68	38	1·79	198
Average	43·6	193·00	195·3

Figure of Merit, 388·3.

The Dr. Carver gun mentioned we consider an exceptionally good gun of its day, and it will be noticed that it has been far surpassed on all points by the 12-bore Pigeon gun with Perfect cases—a gun in no way an unexceptional performer.

The smaller bores, too, all have an increased pattern and force if constructed and bored especially for "Perfect" cases.

Shooting of 14-bore Gun, with Perfect Cases, 40 yards, $3\frac{1}{4}$ drms. Black Powder, and $1\frac{1}{8}$ oz. No. 6 Shot.

	On Gauge.	Force.	Total Pattern.
	55	2·51	211
	55	2·55	205
	45	2·38	217
	39	2·20	204
	46	2·28	216
	59	2·56	223
	56	2·55	209
	51	2·35	227
	63	2·65	225
	53	2·55	211
Average	52	2·45	214
Highest	63	2·65	227
Lowest	39	2·20	204

Figure of Merit, 459.

With $3\frac{1}{2}$ drms., and $1\frac{1}{8}$ oz. No. 6 Shot.

	On Gauge.	Force.	Pattern on 30-in.
	45	2·29	223
	57	2·28	235
	66	2·53	245
	64	2·47	239
	48	2·40	226
	57	2·72	228
	59	2·51	239
	42	2·38	219
	62	2·50	235
	63	2·40	239
	43	2·32	225
	49	2·39	225
Average	54	2·43	231
Highest	66	2·53	245
Lowest	42	2·28	219

Figure of Merit, 474.

July 22nd, 1882.

Shooting of 16-bore Gun, with "Perfects," 3 drms. Black Powder, and 1 oz. No. 6 Shot.

On Gauge.	Force.	Pattern on 30-in.
61	2·41	197
64	2·30	203
52	2·50	193
59	2·42	194
54	2·35	186
49	2·43	180
53	2·32	188
62	2·52	199
56	2·39	183
48	2·56	191

On Gauge.		Force.		Pattern on 30-in.
50	...	2·36	...	196
56	...	2·27	...	197
Average 55	...	2·40	...	192
Highest 64	...	2·56	...	203
Lowest 48	...	2·27	...	180

Figure of Merit, 432.

July 29th, 1882.

Shooting of 20-bore Gun, with "Perfects," Black Powder, $2\frac{3}{4}$ and 1 oz. No. 6 Shot.

On Gauge.		Force.		Pattern on 30-in.
52	...	2·27	...	209
35	...	2·21	...	192
37	...	2·27	...	193
41	...	2·32	...	188
50	...	2·32	...	190
51	...	2·24	...	191
48	...	2·25	...	192
47	...	2·40	...	193
44	...	2·21	...	193
33	...	2·27	...	184
46	...	2·15	...	199
45	...	2·16	...	188
Average 44	...	2·25	...	194
Highest 52	...	2·40	...	209
Lowest 33	...	2·15	...	184

Figure of Merit, 419.

A comparison of the tables shows that guns using "Perfects" give patterns of unsurpassed regularity ; the force is greater, and the averages higher than in paper-case guns of two sizes larger in the gauge. A 14-bore Perfect gun gives better results than any of the 12's at past gun trials, whilst a 12-bore Perfect gun of no greater weight than $7\frac{1}{4}$ lbs. will give such closeness of pattern as to render it a *sine quâ non* for pigeon shooting, and other sports in which extra force is required. They, and much further testimony also, tend to prove the regularity of force from these new guns, and the even patterns, well-distributed, give larger continuous killing circles, doing away with the smashing of game at short ranges, or missing them at longer distances through patchy and wild shooting.

Guns so built have not as yet become popular, but we fully believe they will eventually supersede the old coned-chamber guns. The following letters appeared in the *Field* of November 25th, 1882, respecting the performance at game of guns so bored :—

"SIR,—In reply to J. E. R. in your issue of the 18th inst., I beg to supply him with all I deem important for him to know as to the effect on game of Kynoch's Cases when used in guns specially bored for them, as he seems to fear that game would be badly injured by them. I had the very first gun bored on that plan that Mr. W. W. Greener turned out, and in respect of injuring game, it is very like all other guns that I ever saw

—if you shoot a thing when too close to you, that thing does not look very well in the bag. But at all ordinary and proper distances one of its chief advantages is that its evenly spread-out pattern protects game from the smashing that guns with a patchy pattern are apt to cause when the bird happens to be caught in a thick patch, while it also ensures a kill where a patchy gun produces a miss if a bird chances to occupy the empty space. For all the patchy guns I saw, were patchy in two respects—too thick in some places, and too thin in others, resulting in smashing or escaping.

"So far from J. E. R.'s fears being well-founded, I can assure him that these guns possess, in a superior degree, the very opposite quality of so even a spread that both these serious drawbacks are better provided against in them than in anything previously invented. And another great point in their favour is, that they appear to be easily made to produce this uniform spread, at least such is my experience, for in the very first gun I ordered on this plan, I obtained exactly what I specified from each barrel—a thing that I found difficult to get from good makers on the old plan, in common with most people ordering a gun, I presume.

"SAWDUST."

"SIR,—Perhaps some of your readers may be interested in my experience of the shooting of a gun made for me by Mr. Greener, and specially bored for the No. 12 brass cases.

"I have given the gun a fair trial at grouse, wood-pigeons, and hares. If held straight, I consider it certain to kill up to 60 yards, and likely to kill many shots at grouse considerably further.

"The gun quite answers the purpose for which I required it—namely, wild shooting late in the season. Its weight is 7 lbs. 10 oz., and the cartridges I used were loaded $3\frac{1}{2}$ drms. powder and $1\frac{1}{4}$ oz. No. 5 shot." (Signed) P. C.

As to the shooting of paper cases in guns specially bored and chambered for brass cases, as we shall presently prove with figures and diagrams, the difference in the cartridge-chamber is, or should be, nil. The barrel being bored nearly two sizes larger to adapt it to the fullest choke necessary for brass-case guns, such barrel and such choke is too wide to control properly the charge when fired from a paper case. A brass-case gun of fullest possible choke will fire well paper cases, and the shooting (providing a waterproof pink-faced, a thick felt, and a card wad are placed between powder and shot) will perform fully equal to a modified choke-bore gun of the same size cartridge-chamber.

There is, however, a middle course possible. We have developed a system of boring and choking guns that gives most surprising results with both brass and paper cases. A 12-gauge can be made to average 260 pellets of No. 6 shot in the 30-inch circle at 40 yards, with $1\frac{1}{4}$ oz., from brass, and an average of 240 from paper cases.

The way that, for the last ten years, we have chambered, bored, and choked our guns, they shoot equally well with paper or brass cases; but we can now make a speciality to shoot brass or paper cases with better results than previously attainable.

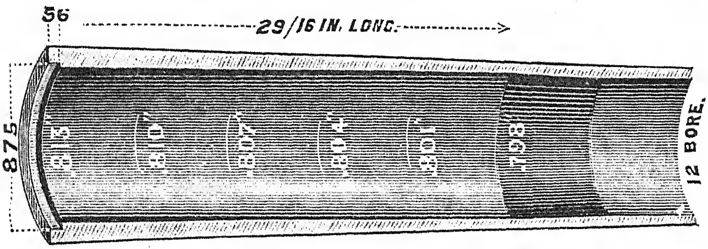


Fig. 315.—The Cartridge-Chamber (actual size).

So much dispute is occasioned by the divers makes and sizes of the cartridge cases by the different makers, amongst whom there is no recognised general standard for outside dimensions of their cases, that we now give the measurements for the chambers of the 12-gauges, and suitable alike for Eley's, Joyce's, and Kynoch's ammunition, whether of brass or paper.

CHAMBERING AND BORING SHOT-GUNS.

The thin brass cases have been popularised, but it will be several years before the paper cases become extinct. The ordinary brass case is also in use, more common, perhaps, in the United States than elsewhere. Sportsmen may not always be able to get the speciality for which their guns have been bored and chambered, and it is improbable that a gun will ever be made that can perform equally with cases ·007 and ·027 inches in thickness. The sportsman, therefore, who—unlike the professional pigeon-shooter—is unable to carry his ammunition with him, and yet must frequent countries in which only foreign cases are obtainable, should have his gun so bored and chambered that it will perform well with any case, but this necessitates inferiority to that highest developement of the choke to which a "perfect" case is best adapted. By chambering a gun to the full size, Eley's, Kynoch's, Bachman's, or any Continental makers' cases will enter.

By adopting a middle course in boring, having the internal diameter of the barrel larger than is usually made for paper case guns, and choked to the fullest extent, results highly gratifying are obtainable, and a gun, 12-bore, with either paper or brass cases, can put 250 out of a charge of 338 pellets into a 30-inch circle at a distance of 40 yards. Poor in comparison with the "perfect" pigeon guns, it nevertheless makes the best all-round gun.

The best possible results, both as to pattern and penetration, are obtainable from those choke-bored guns in which the internal diameters of barrel and cartridge-case correspond, and which have no cone or sharp contraction from base of chamber to choke at muzzle. Square-

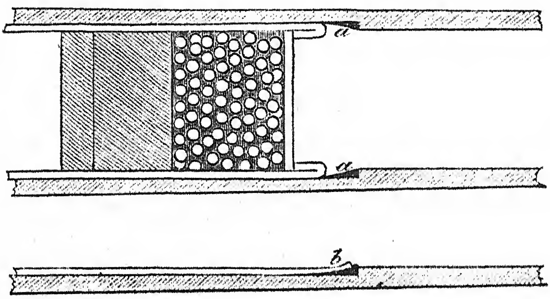


Fig. 316.—Diagram of Chamber Cones.

shouldered chambers for paper cases are more disadvantageous than the now objectionable coned chamber.

It will be seen from the illustration that the extremity of chamber, *a a*, is the weakest portion in the breech end of the gun barrel; if a coned chamber is left in—even if so little as shown at *b*—there is a material increase in the strength of the barrel at that point. The abrupt shoulder, to create which the metal—shown in black at *a a*—must be removed, is most difficult to keep clean, and corrosion quickly ensues, at this, the weakest and most dangerous point in the barrel. Or, providing it becomes clogged with powder residuum and other matter from cartridge-case or cleaning gear, a cone is formed as at *b*, which possesses the disadvantage of a cone, but enhanced by its suddenness.

Any obstruction that tends to crush the shot before they reach the choke causes irregularity of shooting. An abrupt shoulder sometimes produces deformed pellets, and these are worthless at target or game. The thin brass cases do not perform nearly so well in guns that have abrupt chamber cones as in those without cones at all, or with cones tapering but little, and that very gradually. If solely for these cases, a gun should therefore be so constructed.

Paper cases, or cases of a thickness of ·02 and upwards, require a cone, and the barrel of a diameter approaching that of the interior of the cartridge-case. But this is not nearly so important as is generally supposed. Now that tight-fitting wads are used in paper cases, the cases themselves being easily expansive, the bore of the barrel may advantageously be larger than the interior of the cartridge-case, and a gun so bored will shoot an ordinary or a thin metal cartridge-case, with far better results than a gun bored and chambered specially for a case of ·007 in thickness will shoot with a case of ·027.

GILBERT'S TWO-EYED SIGHT.

With the object of rectifying errors of natural vision, the inventor, after years of continued study and observance, has produced the sight here shown.

A theory difficult to understand, still more difficult to explain, is advanced as the *raison d'être* of this two-eyed sight. Fortunately, a clear comprehension of the theory is not necessary to obtain the full advantages of the sight to the user; and as numerous sportsmen have put them to the practical test, and spoken of their utility, this but indifferently understood invention is deserving of further study.

To epitomise the theory: better shooting and more clear and extended vision is obtained with both eyes open. Both eyes can, however, only be focussed at one distance in a direct line from the shooter, and not simultaneously at two distances on that line. It is impossible to correctly focus the eyes upon the sight of the gun and the object aimed at, at one and the same time. Clearly, therefore, one eye must align the gun, or faulty aiming will result. Frequently one eye has stronger vision than the other, and this more generally directs the

aim. Many sportsmen unconsciously shoot with both eyes open, thinking they close the left, but in practice they rarely do so; in short, the aim at moving objects is in the great majority of cases directed by both eyes. The extent to which an aim taken with both eyes open—both eyes being equally powerful—is on an average a divergence of 4 feet from the truth at 25 yards' distance. Shooting with both eyes open is preferable to

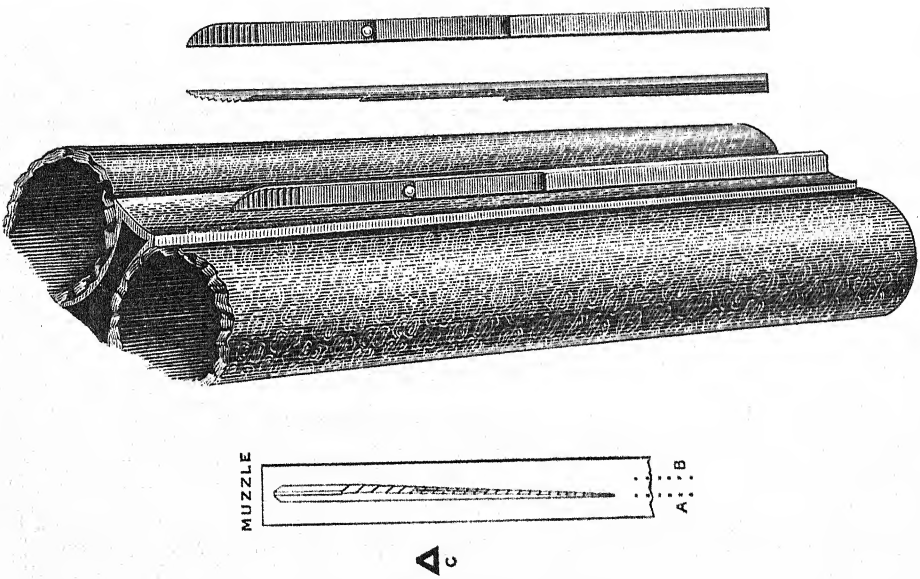


Fig. 317.—The "Two-Eyed" Sight.

accurate aiming with a shot-gun, and possesses greater fascination and gives more pleasure than any other way of shooting. To remedy the difficulties accruing from the tendency of both eyes to take part in aiming the gun, which can be correctly done with one eye only, Mr. T. Gilbert has devised the elongated sight, now known as his "two-eyed" sight. It is affixed to the muzzle of the gun, and is shown full-size; a glazed plain surface is presented to the non-aiming eye so as to prevent it cross-focussing with the aiming eye. To the aiming eye, be it right or left—according whichever is the stronger

in the individual shooter—must be presented an attractive sight. This is best accomplished by roughing, notching, and relieving one side of the long sight. The series of successive notches, together with a bright platinum bead on the dulled dark surfaces, presents an overpowering attraction to the aiming eye, over the blank surface of the non-aiming eye, and the former, consequently, alone aligns the gun, but the advantages of shooting with both eyes open are retained. This sight has been strongly advocated by some of our best shots, and several sportsmen have asserted that their shooting has been greatly improved by its use.

THE "GREENER" BRASS CARTRIDGE CASE CRIMPER.

This machine is designed to fix the wad and charge in brass cases. This is effected by corrugating or crimping the case longitudinally from its mouth to the top wad over the charge.

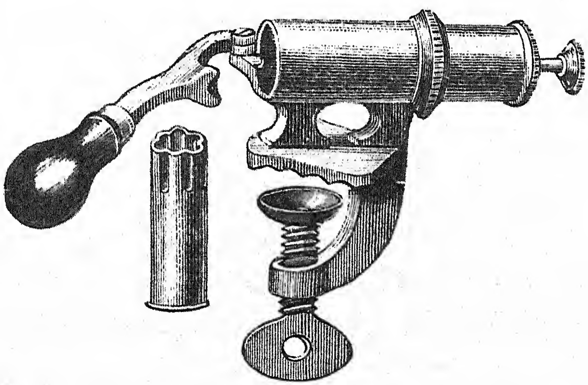


Fig. 318.—The Greener-Lightwood Brass Cartridge Case Crimper.

The cartridge when loaded is put into the machine and forced past projecting studs, thus the empty portion of the case is contracted over the wad, and the charge thus securely fastened in the case.

A hand crimper on the same principle has been adopted by Messrs. Kynoch, and the case may be further contracted by compression in a cone, if so desired, but this principle of corrugation after the cartridge is loaded is the only reliable method of securing the charge.

SHOOTING NOTES.

SHOOTING SONG.

ALL the sports of the field are delightful, I own,
  But none can with shooting compare ;
'Tis a joy that entices the king from his throne,
  'Tis a joy that the wisest may share.

The voice of the hound on the breeze of the morn,
  The note of the bugle may please,
The song of the wild bird is sweet from the thorn,
  But the *gun* hath more music than these.

While thousands are doom'd ev'ry moment to yield
  To bus'ness or studies severe,
The sportsman enjoys the pure air of the field,
  And roams without sorrow or fear ;

He sighs not for honour, for splendour, or wealth,
  Better blessing than either attend him,
Behold on his brow sit contentment and health,
  And the dictates of conscience befriend him.

Old Ponto, sagacious, with head to the gale,
  Ranges backward and forward with joy,
The scent, all at once, his quick nostrils inhale,
  And he points where the covey doth lie.

Tis' a picture to view him, aye, beauteous and grand
  Like a statue he's fixed to the plain ;
The birds are on wing, but the sportsman's at hand,
  And a brace fall to rise not again.

When home he returns, at the close of the day,
  His soul with new pleasure is crown'd,
For then 'tis the pride of his heart to display
  All his sport, as the bottle goes round.

Fatigu'd just enough to increase his delight,
  At length to his chamber he goes,
Soft slumbers unbroken attend thro' the night,
  And rosy dreams bless his repose.

WATTS.

From the time of Nimrod to the present day the capture of wild animals has always afforded man the keenest enjoyment, and no occupation is more healthful, invigorating, or beneficial.

Although over-indulgence in anything is hurtful and brings satiety, nothing is less prone to pall than shooting. The ping of the rifle bullet or crack of the shot gun have charms that never tire. It would be superfluous on our part to write up the pleasures of the field and forest; the votaries of the chase are even now too numerous, and each year sees an alarming increase in their number, whilst unfortunately game (especially the large mammalia) is rapidly decreasing.

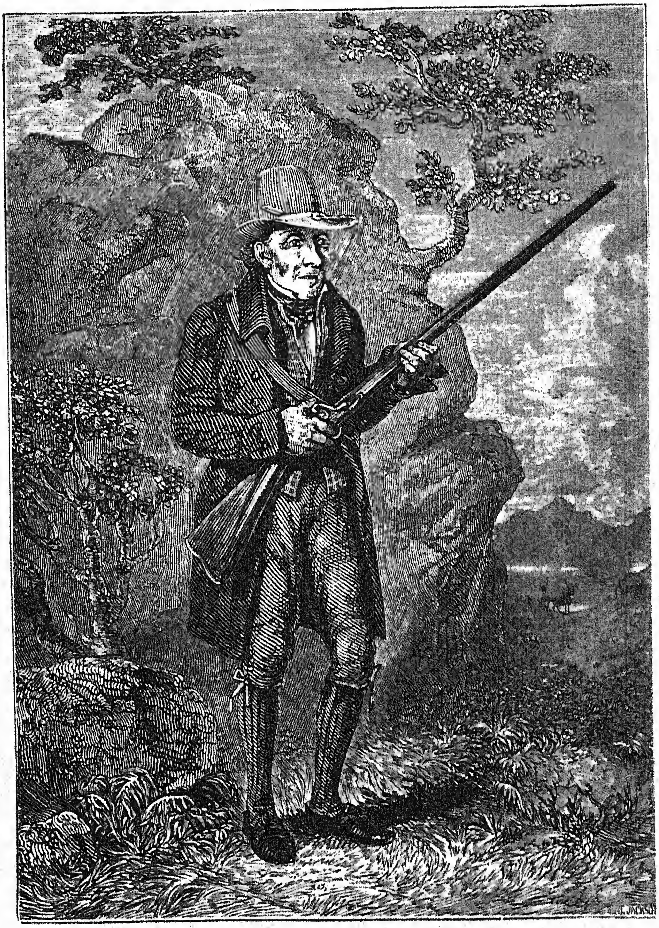
Although at first satisfied with hedge-popping, at fieldfare, and such

Sportsman of the Fifteenth Century.

like shooting, the Englishman, with his adventurous spirit, seeks more difficult game, and partridge, grouse and ground-game will all in due time fail to satisfy his craving for excitement; if means and time allow, his future quarries will be the deer of Britain and the numerous large game of foreign countries.

So general has it now become for Englishmen with time and means at their disposal to seek sport in foreign countries, that we have compiled this portion of the book trusting it will prove useful in deciding where to go for all kinds of game, and also to others whose occupation takes them abroad, and who are only too glad to hear if any shooting is to be had near their foreign home, and of what it consists.

We first, however, consider it appropriate to remark upon the history of game-shooting, the handling and use of guns, and the sports of our own country. The first may be interesting to some, the second cannot fail to



A Sportsman of the Old School.

be of use to young sportsmen, whilst the chance of obtaining a varied bag causes as much pleasurable emotion to some Englishmen as combating savage beasts does to others.

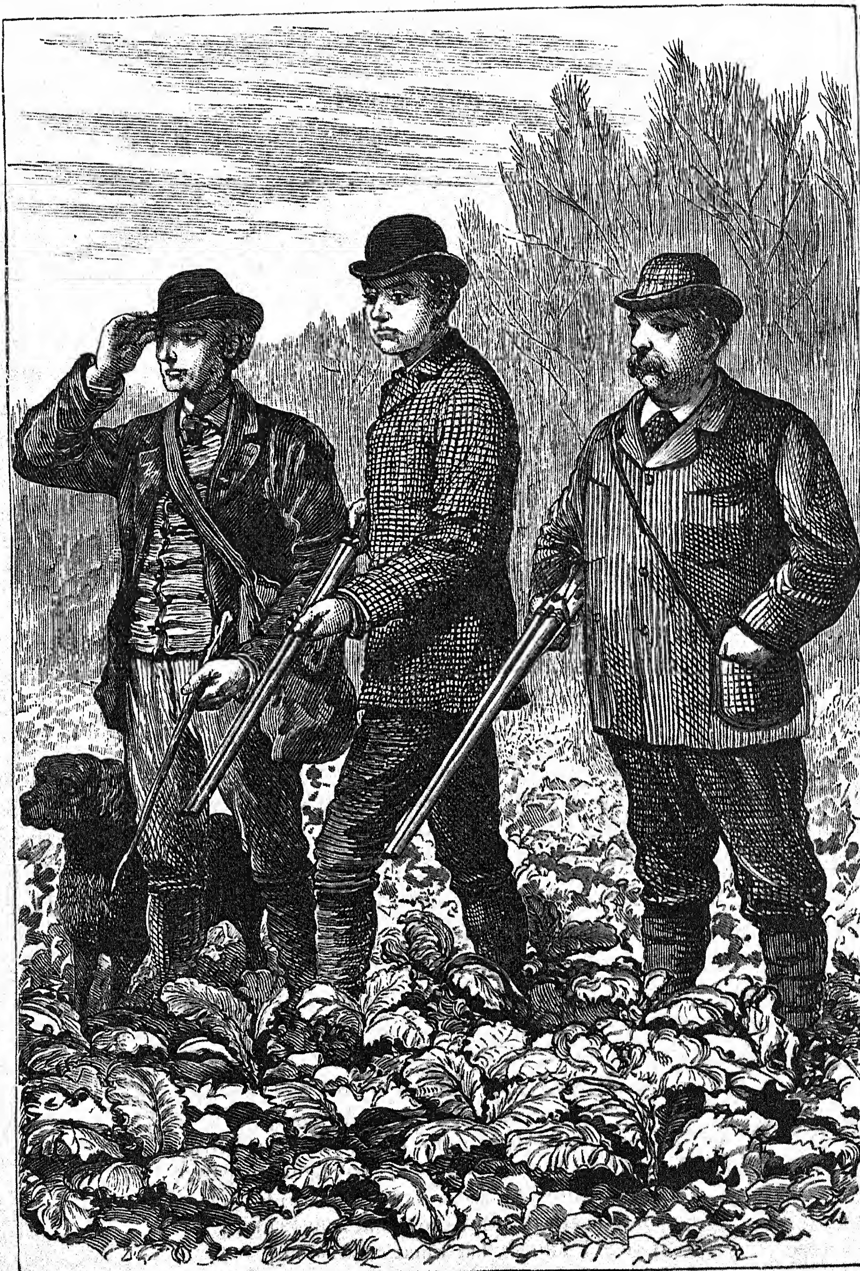
It is doubtful at what time guns were first used as sporting arms, but early French and Italian works seem to indicate the close of the fourteenth century.

The adjoined illustration is from an old manuscript, entitled "Ye Gonne and howe to Use itt," dated 1446. This curious sketch is evidently a caricature, but it is sufficient to show that firearms were used for game shooting in the early part of the fifteenth century. We get notices of the same in several records of the fifteenth century, and by the middle of the sixteenth the gun seems to have become so general a sporting weapon as to necessitate special regulations in many European countries. About 1580, an Italian work informs us, shooting at birds flying and animals in motion was first practised, but this could not have been to any great extent. It was the close of the eighteenth century before shooting on the wing became at all common, and from that time it has been so universally practised as to make shooting at a fixed object with a shot gun unsportsmanlike.

The well-balanced and light guns made by the crack makers of the early part of this century greatly favoured snap shooting, and many of the sportsmen of those days, if they did not make such large bags as those of to-day, enjoyed sport into a good old age, and were hale and hearty to the last. We show one of these old-fashioned sportsmen, whose exploits with the rifle were most numerous. He killed deer running in his eightieth year, and could even bag his venison at ninety-one. His further exploits and eccentricities are noticed in Mr. John Colquhoun's interesting work on the "Moor and Loch," and it is to his courtesy we are indebted for the illustration.

This old forester, a relic of the Clan Colquhoun, was an inveterate sportsman, and one to whom Dibdin's excellent epitaph is singularly applicable :—

"His *course* was *honour* and correct his *aim*,
His bold *pursuit* was fair and manly *game*,
No sports he lov'd but those which could be *shared*,
Nought *kept* he which to friendship might be spared,
Let fame praise who she will, we're free to let her,
Yet underneath this turf she'll find a BETTER !
His placid kindness, felt where'er he went,
Arose from worth, health, exercise, content !



Sportsmen of the Modern School

He 'looked before he leaped' with steady eye,
Never *o'erlooking fallen adversity;*
In short, as says the song, 'Like *fruit that's mellow,*
Gently *he* fell, a DOWNRIGHT HONEST FELLOW!'"

So much for the days of flint and steel. It is seldom sportsmen shoot alone now. Drives or *battues* are much more in vogue; otherwise sportsmen, as a rule, shoot in company, often substituting markers for pointers and setters, and contenting themselves with a retriever, and not always that. This method of walking the game is not half so pleasurable as shooting over well-broken dogs, but if properly carried out it invariably ensures a larger bag.

Hammerless guns are coming into general use, and young sportsmen are more frequent than the old ones, who cannot always walk fast enough to keep the line; and in these days of breech-loaders none care to wait for the old-fashioned gentlemen to charge their muzzle-loaders and rest themselves at the same time.

HINTS ON THE HANDLING AND USE OF GUNS.

The sooner a boy is entrusted with a gun the better—at first, of course under supervision; but as soon as he witnesses the effect a charge has upon living animals it will in most instances be superficial to impress the necessity of care in handling or danger of pointing a gun towards a fellow-creature.

Those sportsmen who have been allowed the use of a gun from boyhood generally make the best and most careful shots, and accidents from arms in their hands are rare. It is only those who fancy they understand firearms that are foolish enough to point where they do not mean to shoot, and who so carry and handle firearms that the muzzle sweeps the whole field, and more often covers the head of the next sportsman than birds on the wing.

A light, short double gun is, in our opinion, the best for a boy to first practise shooting with. To commence with, the left barrel only should be used; and as the boy grows he may make use of the right barrel, and this will obviate lengthening the stock. It is as well to commence shooting at fixed marks, and afterwards practice at glass balls or similar contrivances, and

at hedge-popping. In the latter case, the only caution we have deemed needful to impress is, *never to get through or over a hedge with a loaded* gun.

As to the art of shooting on the wing, opinions widely different are credited by many well-experienced sportsmen. The lines of Watts, although old, are, however, applicable to modern sportsmen. The gist of his advice is contained in the following rhymes on Shooting Flying:—

"A few remarks may this explain,
Yet long 'twill take that art to gain,
Unless, with zealous patience, you
The following advice pursue:—
Remembering that nothing will
So certainly advance your skill
As sober habits, which preserve
Both strength of mind and strength of nerve—
Two matters that are influential
In many sports, in this—essential!
Walk, with a steady dog, o'er ground
Where partridges are quickly found.
However numerous they rise,
Look but at one, with both your eyes;
Then, elevate the tube with care,
Still gazing on the bird in air;
Follow it not along the sky,
To take a formal aim, but try
To draw the trigger just as you
At the gun's end the object view.
Nine times in ten the gun is right
At first, obeying well the sight;
But if you look, and look again,
And doubt, and waver, it is plain
Your hand has ev'ry chance to be
Betrayed by such uncertainty.
Proceed, then, as I just have taught,
The pleasing knack will soon be caught;
But let me re-advise (for this
Prevents, I'm certain, many a miss);
Close neither eye, some good shots say,[1]
Shut up your left, that's not my way;
But still, a man may take his oath
He'd better shut one eye than both."

It is now acknowledged that it is better to make use of both eyes, and to pay no attention whatever to the gun whilst aiming. In short,

the *eye*, *hand*, and *trigger* must act in perfect unison, and without any consideration having to be given to either. On a bird rising, the hands should *intuitively* raise the gun until it covers the object, from off which the eyes are not taken before the trigger is pulled. This only requires practice, and if such is forthcoming, and the body kept in perfect health, a good wing shot is sure to result.

Health is undoubtedly of the greatest importance to professional shots, and is necessary to good shooting. It cannot be expected that one who has not the power over his muscles to keep the hand steady can exert them to raise at once a gun and level it to the greatest nicety.

It is now the prevailing notion that most misses are caused by shooting behind or below the mark aimed at. To remedy this, straight stocks are recommended, and the following method has been devised to ascertain whether the gun is properly brought up. The shooter is to place himself three or four yards from a good-sized mirror, and aim at his own eye, raising the gun repeatedly, steadily but quickly, as in shooting at a bird. On looking into the mirror, with the gun as brought up to the shoulder, if the two round holes, or end elevation of the muzzle, is alone discernible in the mirror, the fit and handling of the gun is theoretically correct; if a little of the lower, or underside, of the barrel is likewise to be seen, so much the better; but if any of the top rib, or top side, of the barrels figures in the mirror, the chances are that nine shots out of every ten will be below the birds.

Now as to hitting fast-flying birds, and game running at full speed. It is a much-disputed point amongst all who use the gun whether the shooter should "hold on," or "ahead." The latter appears to have the best of the argument, theoretically and practically. To prove that either plan is the correct one would be next to impossible, but, with due deference to the majority of sportsmen, we hold with the practice of "holding on." A great deal of the difference doubtless is caused by the manner of bringing up the gun the shooter has acquired; some bring up the gun with a "swing" in the direction the mark is moving, others bring up the gun and follow the object, whilst the majority of good shots put up the gun and, it is supposed, fire "ahead." Now, those who shoot with the gun on the "swing," and who *intuitively* increase the speed of the "swing" in the same ratio as the increase in the speed of the mark, never require to "hold

ahead," even in the opinion of the strongest supporters of the "hold ahead" theory. The second class of "poking shots" are generally most uncertain in their aim, and the habit is detrimental to becoming an expert snap shot; whilst we cannot but believe that many who imagine they "hold ahead," in reality "hold on" in quick shooting.

In the first place, having practised raising the gun and perfecting the handling so that it shall intuitively follow the eye, it must be most difficult to point the gun away from the object at which both eyes are staring, and if the eyes are removed from the object to some distance ahead, it is impossible to accurately tell what distance the line of aim is from the bird. This is especially the case when gazing at the sky, and for a shooter to be able to aim ten or fifteen yards ahead, as is advised by some wild-fowlers, is next to impossible to do with regularity. When gazing at no fixed object, it is as easy to move 30° across the sky as ten yards, and that without being aware of the discrepancy. Those who hold on, by shooting promptly, prove the truth of the theory that it is necessary for the hand and eye to act in unison; whilst they who hold ahead, although agreeing that the hand must follow the eye, yet so shoot that the hand must point the gun in a different direction to the object on which the eye is fixed. If the hand can be entrusted to intuitively direct the gun to any required distance above or before the object upon which the shooter's gaze is fixed, well and good, such an one is likely to be a perfect shot.

An ordinary full-choke possesses a killing circle of at least thirty inches in diameter at thirty yards; so that saying a bird crossing was fired at by one of the "holders on," the shot travelling at the rate of 225 yards per second (see Table, *ante*), would reach the bird at thirty yards in less than 1-5th of a second from the instant of pulling the trigger, so that it would indeed be a fast-flying bird to get without the killing circle in that time. The time required from the instant of pulling the trigger to the explosion of the cap is greater than that occupied by the shot travelling fifty yards; but in hammerless guns the time is less than in hammer guns, the blow given being much shorter and direct, instead of being conveyed by an exploding-pin.

Some quick shots, however, anticipate the time it takes to *fire* the gun, and pull the trigger whilst raising the gun to the shoulder. This requires considerable practice to perfect, and the gun must, of course, be

within an ace of the proper position; but, however the practice may be deprecated, it is certainly *au fait* for trap as well as general snap shooting.

In grasping the gun, a disputed point is the position of the left hand. As a rule, sportsmen grasp the barrels in the very weakest place—viz., just in front of the cartridge chambers. Others again, to shield themselves as far as possible from danger, grasp the front of the trigger-guard by the left hand. This position is erroneous, as but little command is obtained over the gun, the liability of injury by the breaking of the breech-action is not at all lessened, and usually a piece of horn has to be attached to the trigger-guard, as in Fig. 296, spoiling the beauty and handiness of the gun.

To have full command over the gun, and at the same time exposing the hand and arm to a minimum of risk in case of a burst, *grasp the gun well forward*—if close to the fore-end tip so much the better—but do not bring the hand nearer to the breech than six inches, and keep the elbow well depressed. By having a proper command over the gun, it can be raised quickly and easily, and even a heavy or clumsy gun may be manipulated with tolerable success.

TRAP SHOOTING.

The origin of trap sho... may be tr... ancient pastime of Popinjay shooting, a game... s and the expert bowmen of mediæval times.

The popinjay was a stuffe... he top o... and used as a target; in so... a certain amount of liberty bei... to the pole. Ho... being the r... during the ... last record...

M... wa... Stamford, and ot... that time clubs have ... wherever the Anglo-S... The first fashiona...

...and ha... through his ...and pavilion, wh...

...ards it by the length of cord ... bird was ...d upon ...

"Iliad," mentions Popinjay shooting, a dove ... to secure it

...ng shot for. The Toxophilite Society

...nt meetings for popinjay shooting; the

...gate, in September, 1792.

...e a fashionable pastime, pigeon shooting

...s of low public-houses in most large towns;

...onised by Lord Huntingfield, the Earl of

...ne fashionable. Since

...eserved for this sport,

...g, near London, was the

...e gun be not cocked...

If the shooter miss-fire with ...

...ored lost.

...pull the trap without notice

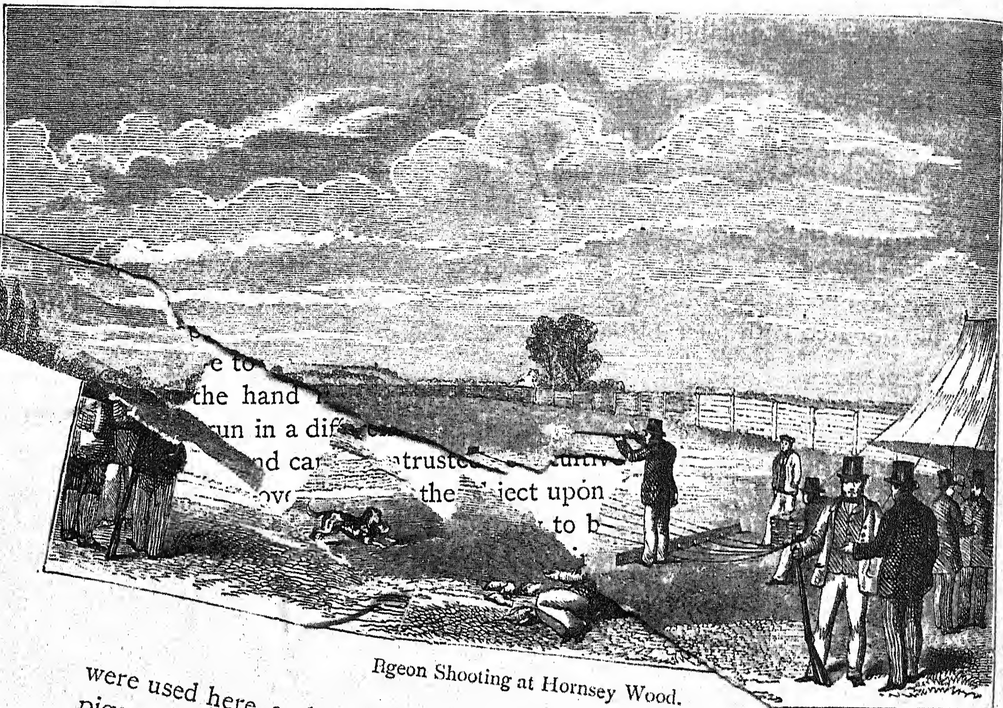
...being pulled, the ...

...if not, he mu...

"Old Hats," a public-house on the Uxbridge Road; it obtained its name from the pigeons used for shooting being placed in holes, covered with old hats, which were the primitive pigeon-traps employed.

The "Red House" at Battersea was the next great metropolitan resort for wager shooting.

The first pigeon club was formed at Hornsey Wood House. Traps



Pigeon Shooting at Hornsey Wood.

were used here, and the "small cannon" which were former... er t... gue as pigeon guns were discountenanced, and the ordinary ... lled fowling-piece substituted. ... time is ... instead ... gun."

We illustrate this—the first fashionable club—by permission of "Stonehenge," who first illustrated it in his work on "The G...

Since 1858 numerous pigeon clubs have sprung into existence, several

codes of rules have been drawn up, and the clubs made select by electing the members and the high fees of membership.

These clubs have each their private grounds, which are open almost daily throughout the summer months. The most fashionable clubs established in London are:—The Hurlingham, the Orleans, and the Gun Club. The latter numbers the most members, and was established about 1861, or soon after the closing of the Hornsey Wood Grounds as a rendezvous for pigeon shooting.

It originated by Sir Gilbert East, Colonel Vansittart, and Mr. G. Batcock hiring a field at Wormwood Scrubbs for meeting once a week with a few friends to have friendly matches and private practice. The numbers wishing to shoot increased so rapidly, that it was proposed by Mr. Batcock to establish it as "The Gun Club," and a lease of the ground was taken. The annual subscription was fixed at £2 2s., and Sir Gilbert East, Bart elected the first president. The Club has since grown to its pr… proportions, and may now be considered the first shooting club … world. The son of the founder, Mr. George Arthur Batcock, ha… secretary of the Club almost from its commencement, and has als… been that time filled the office of handicapper. It is through his co… we have been able to sketch the grounds and pavilion, which … during

There are generally upwards of forty fixtures … we illust… and usually the events are well contested. The … for each as the standard throughout England, we now g… rules, which … un… in full:—

THE GUN CLUB RULES—AUG…

1.—The gun must not be carried to the shoulder … shooter has called "Pull."

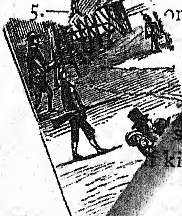
2.—A miss-fire is no shot under any circumsta…

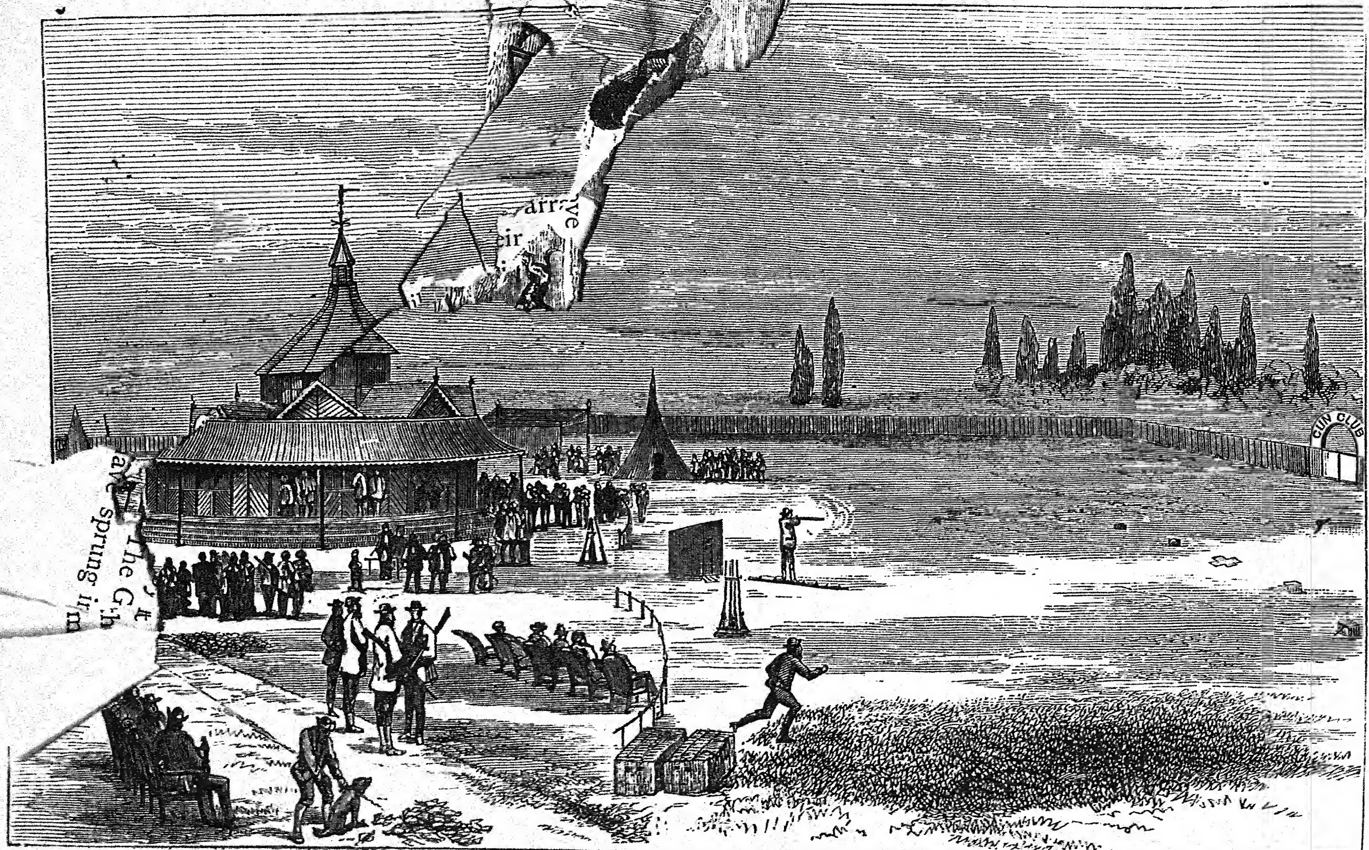
3.—If the gun be not cocked it is a lost bir…

4.—If the shooter miss-fire with the f… and use the second and miss, the bird is to be scored lost.

5.—… on pull the trap without notic… from the shooter he has the option to t…

… oes not rise, it is at the option of the … ap being pulled, the … are it by saying "No bird." If the bird … if not, he m… bird be liberated, the shooter may say "No … shooter shoot at … sts he must abide by the results. … killed, is "No bird," if





"The Gun Club" Ground, Notting Hill.

8.—*Double Shooting.*—If more than two traps be pulled, the shooter may say "No birds," and claim two more; but if he shoots he must abide by the result.

9.—A bird to be scored good must be gathered by the dog or man, without the aid of a ladder or any other instrument.

10.—All birds not gathered in the ground to be scored lost.

11.—If a bird that has been shot perches or settles on the top of the fence, or any of the buildings higher than the fence, it is to be scored a lost bird.

12.—Or if a bird perches or settles on the top of the fence, or on anything on the ground higher than the fence, and then falls dead on the ground, it is a lost bird.

13.—If a bird once out of the ground should return and fall dead within the boundary, it must be scored a lost bird.

14.—Should a bird that has been shot be flying away, and a "scout" fires and brings the bird down within the boundary, the referee may, if satisfied the bird would not have fallen by the gun of a shooter, order it to be a lost bird; or, if satisfied that the bird would have fallen, may order it to be scored a dead bird; or, if in doubt on the subject, he may order the shooter to shoot at another bird.

15.—A bird shot on the ground with a first barrel is "No bird," but it may be shot on the ground with the second barrel, if it has been fired at with the first barrel while on the wing.

16.—A bird killed on the ground with the first barrel is "No bird;" if a bird be shot at on the ground with the first barrel and it escape, it is a lost bird.

17.—The shooter is bound at any time to gather his bird, or depute some person so to do, when called upon by his opponent; but in so doing he must not be assisted by any other person or use any description of implement. Should he be in any way baffled by his opponent, or by any of the party shooting, or dog, he can claim another bird with the sanction of the referee.

18.—The shooter cannot leave the shooting mark under any pretence to follow up any bird that will not rise, but is walking away from the trap after it is pulled; and, having once left the mark, after shooting at the bird, cannot return to shoot at it again under any circumstances.

19.—In matches or sweepstakes any shooter found to have in his gun any more shot than is allowed, to be at once disqualified.

20.—Any shooter is compelled to unload his gun on being challenged; but if the charge is found not to exceed the allowance, the challenger shall pay £1 to the shooter, which must be paid before he shoots again.

21.—A shooter may at any time object to the use of a spring trap, either in a match or sweepstakes.

22.—None but members can shoot, except on the occasion of the open handicaps.

23.—That breech-loaders be not loaded until the shooter is at the mark; and, on leaving the mark, should a cartridge not have been discharged, it is to be removed.

24.—No wire cartridges allowed; nor is any bone-dust, or other substance, to be mixed with the shot.

25.—Should any shooter shoot at a distance nearer than that at which he is handicapped, the bird, if killed, is "No bird;" if missed, a lost bird.

26.—That $1\frac{1}{4}$ oz. of shot be the maximum charge for all occasions, except private matches.

27.—That all muzzle-loaders be loaded with shot from the club bowls, and that 1s. per day will be charged each shooter for shot.

28.—In handicap sweepstakes, winners under £10 go back one yard ; £10, and up to £20, two yards ; £20, and over, three yards. Unless a sweep be worth £5, the winner does not go back.

29.—In shooting in a sweepstakes of three birds, five birds, or six, shooters can only enter and commence to shoot up to the end of first round ; after that number of birds, up to the end of the second round.

30.—Distance of new members, twenty-seven yards.

31.—Thirty-one yards being the maximum distance, should any one win at that distance, all remain as they were in such sweep.

32.—In large sweepstakes, if the money does not amount to £100 it shall be divided into two prizes.

33.—After the first three sweepstakes of the value of £5 and upwards have been shot on any day, members joining in the sweepstakes to go back one yard beyond their regular handicap distance.

34.—Winners dividing £9, or less, in a handicap do not incur any distance penalty.

35.—In even distance shooting should a winner win at or above his handicap distance, he is to be penalised for such win in the handicap book.

36.—During shooting hours, or whilst any sweep or match shall be in progress, or be desired by any member, no shooting at birds thrown up, or other irregular practice with guns, shall be permitted on the ground.

37.—Should two members agree to save stakes, and one of these divide with a third person, the member so dividing shall pay the full stake to the member who does not win or divide.

38.—In case of any division of stakes in advertised events, the amount of division is to be declared to the referee, and the members dividing shall be penalised to the amount they receive. This rule not to apply to the saving of stakes.

39.—The size of chilled, or ordinary shot, is restricted to Nos. 5, 6, 7, 8.

40.—No member allowed to shoot in any sweepstakes or handicap until he shall have paid the amount of his entry to the scorer.

41.—No round shall commence in any sweepstakes previous to the advertised event of the day after three o'clock.

42.—The handicap distances shall range between twenty-one and thirty-one yards.

43.—The weight of gun is limited to 8 lbs., and the charge of powder to 4 drachms.

44.—No guns above 11-bore allowed.

The following fines will be strictly enforced :—Pointing a gun at any one, £1 ; firing a loaded gun without permission, except at the mark, £1.

THE HURLINGHAM CLUB.

The rules of the Hurlingham Club are similar to those of the Gun Club, with the following restrictions :—The guns must not exceed 7 lbs. 8 ozs. in

weight; and $3\frac{1}{2}$ drachms of black powder and $1\frac{1}{4}$ oz. of No. 5, 6, 7, or 8 shot, is the maximum charge allowed. No scouting is allowed on the club premises, and the shooter cannot under any circumstances gather his own bird, but must depute some one to do so.

The Hurlingham Club has not been so long in existence as the Gun Club, but is considered more select; in the value of the prizes and the amount of the sweepstakes there is but little difference between the two clubs.

The other leading clubs in England are the International Gun and Polo Club, holding its meetings at Brighton, the Manchester Gun Club, and the Middlesex Club. There is also good pigeon shooting at the "Welsh Harp," Hendon, during the summer.

PIGEON SHOOTING ON THE CONTINENT.

In France, Germany, and Italy pigeon shooting has been well received, and the International Concours arranged at several of the leading watering-places are carried out with much *éclat*, and the attendance is very numerous. In France, perhaps, pigeon shooting is more arduously pursued, and as many of our English sportsmen may visit that country, we will notice their rules in full:—

CERCLE DES PATINEURS. (SKATING CLUB.)

This club, the leading pigeon shooting club of France, has its grounds situated in the Bois de Boulogne, together with an ornamental lake, on lease until the end of 1885.

The shooting takes place upon a large enclosed lawn, called the Pelouse de Madrid, and is immediately adjoining the lake. The club is composed of the founders and subscribers, and is managed financially by the founders, fifteen in number; there are two sub-committees, who manage respectively the skating club and the pigeon shooting tournaments. To become a member of the club it is necessary to be presented to the committee by a founder and an ordinary member. The name is then adjoined to the list of candidates, who are voted in by ballot. The entrance fee is 100 francs, and the annual subscription the same. With a

few additional modifications, the pigeon shooting rules of the Cercle des Patineurs are the standard rules of France, Switzerland and Italy, and substantially adopted throughout the Continent, so we append them in full :—

PIGEON SHOOTING RULES.

1.—A pigeon shooting club is established at the Cercle des Patineurs.

2.—Members of the club only are admitted, but nevertheless for persons other than members, on the request and under the express responsibility of a member, an entrance-ticket to the grounds may be obtained, available for one day. This ticket, which costs 10 francs, is not transferable, and ought to be signed by the member who requested it and a member of the committee. Members of the Hurlingham and London Gun Clubs are considered honorary members of the Cercle des Patineurs, unless their visit to France should exceed two months, in which case they ought to be formally presented.

3.—The committee have the right to reserve certain days for public shooting, and to issue special tickets upon those occasions.

4.—M. Homillier Blanchard, gun-maker to the club, will place at the service of members of the club muzzle-loading guns, cartridges, and accessories. Every liberty is given to others to bring the guns and cartridges of the shooters.

5.—10-bore is the largest bore allowed, 10 grammes 20 of powder, and 36 grammes of shot is the heaviest load permitted. No. 5 is the largest shot that may be used.

[English measure, 4 drachms powder and 1¼ of shot.]

6.—Wire cartridges and cartridges specially made to increase the range are, on grounds of safety, strictly forbidden ; nevertheless concentrators may be used.

7.—The members of the committee choose one or more referees, whose decisions in all cases shall be final. They also act as handicappers. They may appoint one or several persons to form a handicap who are strangers to the committee, and if they deem it advisable they can examine the cartridges and loads, and enforce the Rules.

8.—The boundary within which the pigeon must fall to be scored good is the half of a circle, having a radius of 80 mètres (87 yards). In the centre is the pavilion. The distance from the centre trap to the boundary is 50 mètres (54 yards, 2 feet).

9.—The traps are five in number, and five mètres (5 yards, 1 foot, 5 inches) from each other.

10.—The shooter must place himself at the exact distance which has been assigned to him, and his feet must not be in advance of the line drawn to mark the distances. The gun is not to be shouldered, but the stock must be below the shoulder of the shooter. If these regulations are not obeyed, the referee may declare the shot "No bird" or "Lost" at discretion.

11.—If the shooter is baffled by a competitor or spectator, or if he is discomposed through any accident whatever, he may claim another bird.

12.—The shooters must succeed each other at the mark without interruption, save in the case of accident, when time will be allowed at the discretion of the referee.

13.—The shooter, when at the mark and ready to shoot, should cry "*Pull.*" Should the trap open before he says the word, it is at his option to take the bird or not; but if he shoots the shot will be scored.

14.—If the trap is sprung and the pigeon does not rise, it is at the option of the shooter to accept or refuse it.

15.—If the pigeon is killed before rising it is "*No bird.*" If it is missed whilst on the ground with the first barrel and killed whilst flying with the second, it is "*No bird;*" but if it is missed under the same conditions with one or both shots, the pigeon is lost. In short, if the shooter waits until the pigeon rises and is afterwards shot at, it is scored *to the shooter.* In the last case only may the gun be brought to the shoulder, but it is well understood that to be scored "killed" no bird must be killed except on the wing.

16.—The shooter has a right to another bird if his gun miss-fires or refuses to go off through any fault not his own.

17.—The pigeon is lost if the shooter has neglected to cock his gun, to load it, or to place on the cap.

18.—If the first barrel misses fire, and the shooter fires the second, he loses his right to another pigeon, unless the second barrel also miss-fires.

19.—If the second barrel misses-fire, the shooter having fired and missed the bird with the first, he may claim another bird; but in that case both barrels must be loaded, the first with powder only, and neither barrel must be discharged until after the trap is sprung.

20.—It is forbidden to shoot both barrels at the same time.

21.—When the shooting is at single birds, and more than one bird is sprung, the shooter may refrain from shooting and declare it no bird, but if he shoots the shot must in all instances be scored.

22.—When shooting at double rises and more than two pigeons rise together, the same right is accorded as in Rule 21.

23.—The pigeon to be scored must fall and be gathered within the boundary; if it falls without or within after having been outside the boundary, it is scored lost.

24.—The boundary within which the birds must fall and be gathered to be scored good is shown by barriers or tape.

25.—A pigeon to be scored good must be killed upon the wing, unless the second barrel is used. One person only must retrieve the bird, and must not employ any instrument to effect it.

26.—All pigeons declared doubtful, that is to say, those which may be supposed to have sufficient strength to fly, although wounded, must, if one of the competitors demand it, be gathered immediately to be scored "killed."

27.—Every pigeon that, after being shot, shall perch or settle on any tree, post, bar, in the enclosure, or on the boundary rail, is scored lost unless it falls dead within the enclosure before the next shooter fires.

28.—The fallen pigeon is not scored until it is gathered and brought home. The pigeons falling into the pool are scored good unless they rise and fly from the enclosure before the next shooter has fired his first barrel.

29.—The shooter who leaves the mark after firing the first barrel loses the right of using his second.

30.—All pigeons shot at behind the diagonal line of banners, whether killed or missed, are scored as lost to the shooter.

31.—Each trap bears a number, and it is entirely dependent upon chance which trap is used.

32.—In the handicaps, matches, and other shooting in which the bore and the load are specified, every shooter having used a gun of a different gauge or a different charge, is excluded from that match, and loses his entrance fee. And every shooter convicted of having shot at a less distance than the one fixed for him loses his right to the stakes or prize.

33.—The standard gauge from which all the distances are calculated is the 12-bore. 11-bores go back half a mètre; the 10-bore one mètre. On the other hand, 14-bores advance half a mètre, and the 16-bores one mètre. Any gauge larger than ten is excluded, and no further advantage is allowed to any gun of less than 16-bore.

34.—From 10 a.m. to noon, and from 1 p.m. to 2 p.m., the shooting is free. Each person shoots in turn, the distances and the gauges not being fixed. From 2 p.m. to 6 p.m. the shooting is exclusively reserved to sweepstakes.

35.—A commission of five per cent. is reserved on all sweepstakes and wagers, but in matches between two shooters only the five per cent. commission will be charged on half the amount of stakes only.

36.—The extreme distance in shooting for stakes is fixed at 30 mètres (33 yards); but the referee may augment it in the case of acknowledged superior shooting.

37.—In shooting for sweepstakes at several pigeons, every shooter who may arrive after the shooting has commenced may enter, provided always that he scores as bad his pigeon or pigeons in the rounds finished before his arrival. For stakes at one pigeon only no one can enter after the first round is concluded.

38.—The winner of a stake amounting to 10 louis, free from all commissions, his entrance fee included, goes back two mètres; if the stake is less, one mètre. This distance is imposed for the day only.

39.—The same shooter cannot be put back more than three mètres the same day, although he may gain several stakes.

40.—If the winner of a stake amounting to 10 louis, his entrance fee included, is already shooting at thirty mètres, he stays at that distance, and the other shooters advance two mètres; or, if the prize is less, one mètre. By this Rule, however, the shooter may be put back to thirty-two mètres instead.

41.—Each shooter has his name written in a book placed on the stand, and the distance varies according to the judgment of the referees, who modify them according to their observations. Their decisions are without appeal.

42.—The days for shooting are fixed by the committee, and may be seen at the Cercle des Patineurs or at the principal clubs of Paris.

FINES.

1.—100 frs. (£4), for shooting at a passing pigeon or other bird.

2.—20 to 100 frs. for every shot fired behind the diagonal line of banners; same fine for shooting the second barrel after leaving the mark.

3.—20 frs., for carrying a gun about the enclosure, unless called upon to shoot.

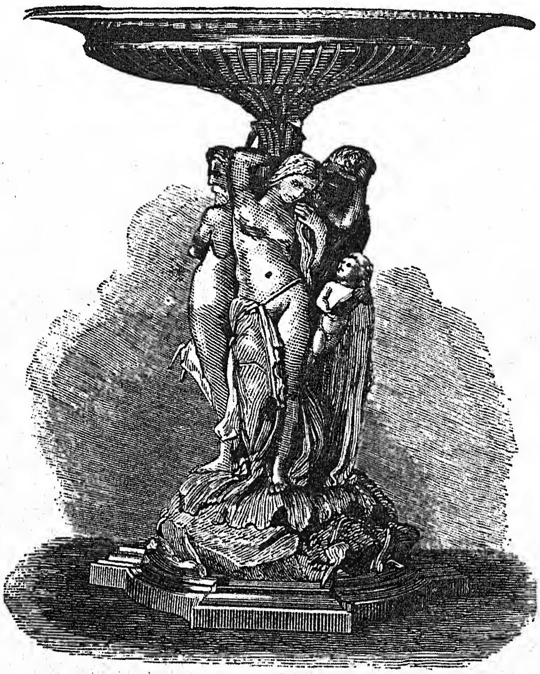
4.—20 frs., if the shooter receives or replaces his gun loaded and cocked.

5.—Muzzle-loaders must be given to the shooter at half-cock, or the armourer fined 20 frs.

6.—Breech-loaders to be loaded at the mark, with the barrels toward the traps, and when the trappers have returned to their places, the shooter or the armourer not conforming to this rule will be liable to a fine of 200 frs.

PIGEON SHOOTING AT MONACO.

Next to Paris the great centre of pigeon shooting in France is at Monaco (Alpes Maritimes), and the International Concours held there



A Grand Prix du Casino.

during January and February surpass any tournaments of a like kind held on the Continent, and attract the best shots of all nations, many English and American professional shooters attending year after year. The prizes offered are most costly, consisting of rare works of art and *vertu*. We illustrate one of these prizes that was won in 1878 by H. Cholmondeley Pennell, Esq., with a W. W. Greener patent wedge-fast 12-bore breech-loader. This prize was valued at £160, and the nett value of the stakes added £1,328. This was the most valuable prize ever shot for at Monaco up to that date, but the last five years prizes of even greater value have been given. The Grand Prix de Monte Carlo is second only to the Grand Prix du Casino; and this, with several other like valuable prizes, form the great attraction to the Monaco shooting, and are well worth a journey through France to obtain.

Intending visitors to Monaco will, however, do better by staying at Nice or Mentone, which are more healthy, and running to Monaco each day for the pigeon shooting.

The pavilion at Monaco is artistically designed and well furnished; it faces the sea, Monte Carlo rising up immediately behind it. The boundary is distant but 17 yards from the trap, is 6 feet in height, with the sea and rocks immediately below. The rules followed are those of the Cercle des Patineurs, already given, with the following special additions. For the Tirs d'Ouverture and Concours Bi-hebdomaires :—

All persons wishing to take part in these matches must present a written *présentation* of one of the Committee of Patronage, or of two members of the following clubs :—The Hurlingham, the Gun Club, the Cercle des Patineurs, or the Tir du Bois de la Cambre. A permit, non-transferable, will then be delivered for the season.

In these matches the prizes will not be joined to the pool unless there are more than eleven shooters. Two pigeons missed to throw out the shooter from that stake. The winner of a prize goes back 1 mètre, the second half a mètre.

The winner of a Poule d'Essai (a small sweepstakes, shot off each day before the principal event) does not go back for the prize following the pool.

For the Grands Concours Internationaux :—

Members of the above clubs or other persons presented by the Committee of Patronage are entitled to take part in these events.

The Committee will appoint judges and handicappers, who will act without powers of appeal. The use of gun cotton is prohibited, but E. C. and Schultze powders may be used.

For the Concours Hebdomaires :—

Same conditions as for the Tirs d'Ouverture, but winners of any prize in the International Concours will go back 1 mètre, and if they win a prize in this series another mètre also for every prize won.

The shooting at Monaco usually commences in the middle of December, and closes the last fortnight in March. At Cannes, about thirty miles from Monaco, there is also fair pigeon shooting during the winter months, but the prizes are not so valuable as those offered at Monaco, nor is the shooting ground so good, or the conditions so rigorous. In the winter also there is pigeon shooting at Pau (Basses Pyrenèes).

In summer the meetings at Paris, Dieppe, Bordeaux, Reims, Boulogne, and Pau are the most important, the rules of the Cercle des Patineurs being observed at all.

In Belgium good pigeon shooting is to be had during the season, both at Brussels and Ostend. The meetings at Brussels, under the auspices of the Tir du Bois de la Cambre, are well worth attending.

In Germany the best meetings are at Baden-Baden and Ems ; in Italy, at Milan and Florence.

PIGEONS AND APPLIANCES FOR PIGEON SHOOTING.

The pigeon generally employed for trap purposes is known as the Blue Rock. The best variety, the Lincolnshire Tin Blue Rock, retain the wild nature of the common blue Coast Pigeon. They are fed in Lincolnshire by the farmers in winter time, who also raise cotes for them at a good distance from their other buildings, as the wilder the birds and the nearer the coast they are raised the stronger and more hardy they are. The true Tin Blue Rock affords the best sport, and is much the hardest to kill ; being small in the body, quick in flight at starting, tough in their nature, and game to the death, especially the hens.

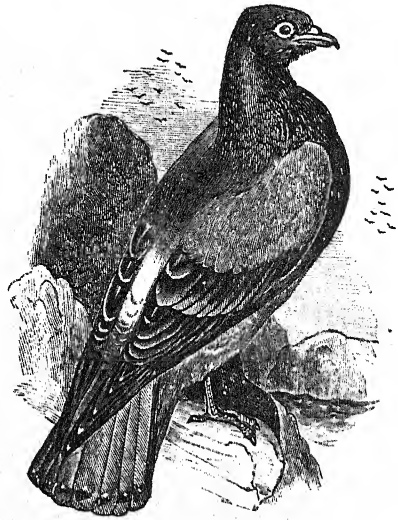
Other Blue Rocks are bred in Oxfordshire and Yorkshire in large quantities, but are inferior to the Lincoln birds.

Many of the so-called Blue Rocks are also imported from Antwerp; in fact the greater portion of the pigeons used for trap shooting are brought over from that port, and sold here as Tin Rocks. Some years ago a number of Tin Rocks were exported to France and Belgium for breeding

purposes, and it is their offspring we now import; the foreign climate has not, however, improved them, as they possess none of that gameness peculiar to the English bird.

The real Rock is not always of the same colour and markings, but, as we imagine, through some cross with the domestic pigeon, there are white and speckled Rocks, which differ only from the Blue Rocks in colour.

The next best bird to the Blue Rock is the English Skimmer, which is chiefly employed at the second-rate clubs, and true Antwerp pigeons.



The Blue Rock Pigeon.

On the Continent Belgian birds are chiefly used—not foreign Rocks, but the common Antwerp pigeon—but for special events, as the Grands Concours Internationaux at Monaco, they usually send to an English purveyor for Tin Rocks, and an Englishman to trap the birds. At Monaco a large dovecote has been erected, and many birds for the minor events are bred there.

A clever trapper will make as much difference in the flying of the birds as there is in the birds themselves. But the cruelties and barbarities often practised for the sake of fraud, with the many tricks of the trade, we think it worthless to enter into.

The traps are usually five in number, the sides being hinged, so that upon the cord being pulled they collapse entirely, leaving the pigeon in the open. The strings are usually manipulated by a patent machine invented by A. G. Batcock, Esq., the secretary of the Gun Club; the machine is worked by a boy seated in a covered box. The strings from the five traps pass through tubes under the ground into a pillar fixed in the box, a ball is dropped by the puller down a spiral incline in the pillar, and it drops upon one of five levers connected with the springs from the traps; the weight of the ball depresses the lever, and brings it into contact with the extremity of another lever moved by hand, to release the trap. The whole apparatus, with traps complete, costs about £30, and may be obtained at 68, Haymarket, London.

At Monaco and Boulogne a different and much more effective machine is employed; it is fixed upon a platform behind the shooter, and consists of a ratchet wheel, pivoted vertically, and so finely balanced that a continuous rotatory motion may be given it by pressing a small spiral spring. The machine, we believe, is of French manufacture, the invention of the manager of the Tir aux Pigeons, Monaco, and works well.

That so time-honoured a sport as pigeon-shooting, practised continuously since the days of Homer, should still enjoy popularity testifies to its inherent worth. As a test of markmanship it will ever remain unexcelled, and the good that has of late years accrued to the gun-trade through its instrumentality cannot be over-estimated. Culled of a few isolated instances of bird mutilation, pigeon-shooting has as good a *raison d'être* and a sheet as clear of cruelty as any sport practised in our country.

That persons desirous of notoriety and cheap popularity are to gain the same by deliberate harm to the interests of many cannot be allowed. And should a prohibitory law against pigeon-shooting be passed by error in estimating the general wish—as only by such or by subterfuge could such a measure become law—the reaction to reinstate all sports will be so great as to cause the revival of barbaric practices wantonly perpetrated as sport.

Sport and cruelty are inimical; one can and does exist without the other. The simple taking of life is but concomitant with existence itself, and to take that life with the least possible physical pain is the endeavour

of every sportsman. May pigeon-shooting as now practiced long flourish in England! It is here that the rules of modern pigeon-shooting were first framed, and from here has extended the fashionable practice of pigeon-shooting throughout the Continent, to India, Australasia, and America. The international and intercolonial matches are a potent force in promoting friendliness and social communion between the individuals of nations and peoples—far more potent than treaties or tariffs.

Cruelty in pigeon-shooting at fashionable resorts and friendly village or county contests is unknown, and but rarely existant even at the roughest meet of "sports."

As marksmen the English were long pre-eminent. Of late the laurels have been fairly divided between English, Continental, and American sportsmen.

The Grand Prix du Casino of Monaco has been won eight times by Englishmen, once by an American, and thrice (the last three years) by Continental sportsmen.

Without a doubt, the shots of Continental clubs have of late years made good progress in the art of shooting flying, and naturally nearly all are now furnished with English guns.

But of all the wing-shots, for speed and accuracy of shooting, the professional pigeon-shots of America must have the palm. Dr. W. F. Carver and Capt. A. H. Bogardus, whose portraits we reproduce, have made the best scores on record; whilst Mr. Ira Payne and Capt. S. S. Stubbs can each present high scores at pigeons as well as at that shooting of which they make a *spécialité*.

PIGEON SHOOTING AND THE BEST SCORES.

Perhaps the best score on record is that of Captain A. H. Bogardus, who on July 2nd, 1880, succeeded in scoring 99 birds out of 100, the 47th bird falling dead out of bounds. This extraordinary score was made in a match with Mr. Rimmell, an English gentleman, for 250 dollars aside. Bogardus, 30; Rimmell, 28 yds.; 100 birds, 5 traps, weather fair, and birds in good condition.

The captain used an English hammerless gun, and loaded with Dittmar powder in the first and orange lightning, No. 6, in the second barrel.

Rimmell used the orange lightning powder, and both were restricted to $1\frac{1}{4}$ oz. shot.

It must, however, be remembered that the American birds are inferior to English Tin Blue Rock pigeons, and that all pigeons are much stronger, wilder and sharper in the early spring and winter than in summer.

Captain Bogardus, when in England, although shooting several matches, never approached the score just mentioned; the best performances being in a match with Mr. Wallace, at the Gun Club Grounds, July, 19th, 1878, resulting in a tie, each shooter scoring 79 birds out of 100. The following Wednesday the tie was shot off, resulting in a win for Mr. Wallace; he killing 72 birds to the captain's 61. On July the 23rd, in the same year, the captain shot a match with Mr. H. Cholmondeley-Pennell at the same grounds; the scores being—Captain Bogardus, 71; Mr. Cholmondeley-Pennell, 69. These scores are amongst the best ever made in England.

On the 16th March, 1881, Dr. Carver and Mr. W. Scott shot off a match at Hendon, 100 pigeons each, 30 yards rise. Score—Dr. Carver, 79; Mr. Scott, who grassed 26 in succession, scored 74. Young Nimrod, a child of eleven, with a Greener 28-bore choked treble-wedge-fast gun, in public matches, has grassed 17, 11, and 13 without a miss at 27 yards, and has, upon more than one occasion, killed 38 out of 50.

On February 7th, 1881, a match was shot off at the Welsh Harp, Hendon, between Dr. Carver, the Champion American rifle shot, and Mr. W. Scott, a celebrated English wing shot.

Dr. Carver used throughout the match a Greener choke-bore gun. Mr. Scott also used a Greener, but after the match commenced shot with the Greener and a London gun irregularly. The score was—Dr. Carver, sixty-six birds; Mr. Scott, sixty-two. The stakes amounted to £400. The birds were the finest and quickest seen during the winter, and the weather was vile: the greater part of the match being shot in a blinding snowstorm, and a driving squall from the south-west.

Dr. Carver shot three matches against Captain Bogardus in the United States this year. The following are the scores and distances:—First match (at Louisville, Ky.; 100 birds, 30 yards rise, 80 yards boundary, Hurlingham rules)—Carver, 83; Bogardus, 82. Second match (at Chicago; same conditions as first match)—Carver, 82; Bogardus, 79; at the 80th round scores were even, and remained so until the 90th, when Carver killed all

Dr. W. F. Carver, C.R.S., Champion Wing-Shot of the World

[illegible] W. F. [illegible]

Captain A. H. Bogardus, ex-Champion Wing-Shot of America.

succeeding birds, and won a well-contested match by three birds. Third match (at St. Louis; 50 double rises at 21 yards)—Carver, 79; Bogardus, 81.

SPARROW SHOOTING.

"Tomtits and sparrows, pippits, larks,
Are all to me as easy marks."

WATTS.

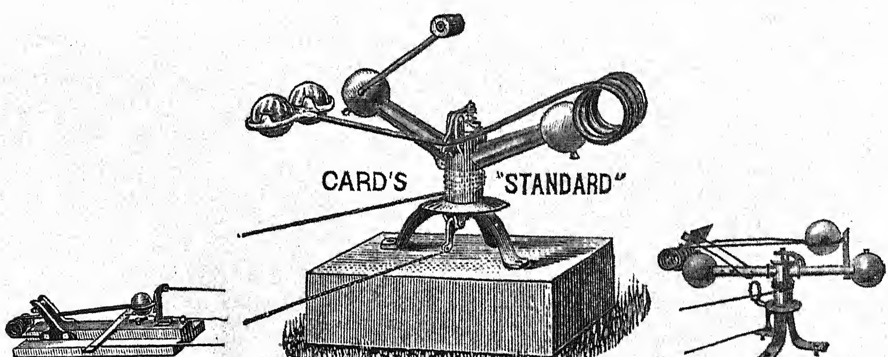
Some sportsmen, when pigeons are not available, and many tyros, make use of sparrows and larks for trap-shooting. If No. 6 shot is used, it is good practice for both game and trap-shooting, and not despicable sport.

Tyros in the art of shooting flying sometimes slip a paper collar over the heads of small birds, to make them fly more slowly and steadily. The best practice for such, however, is

ARTIFICIAL PIGEON SHOOTING,

a pastime long practised in this country, but developed and made fashionable in America by Ira Payne and Captain Bogardus.

In England catapults were used to spring the balls, but in America

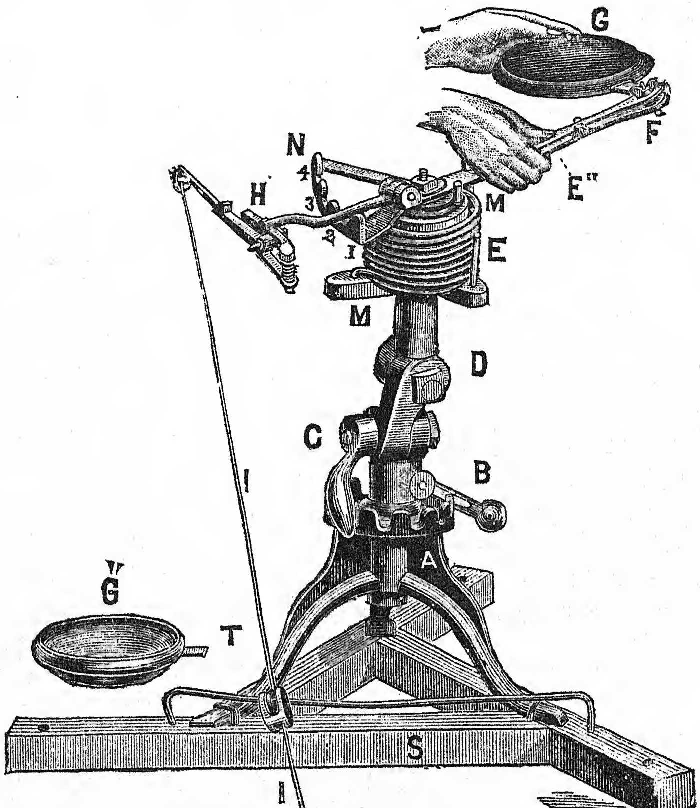


Greener's Combination Trap. The Card Revolving Double Trap. Simple Rotating Trap.

spring traps were invented. Many patterns have been produced, and the best here illustrated.

The revolving is the latest American improved trap; it will project one

or two balls in any direction (except towards the shooter), or it will rotate throwing balls in a direction impossible to foresee. Like the simple rotating trap, it can also be adjusted to send the balls at various distances and heights. The simple rotating trap throws the balls in every direction



The Clay Pigeon-Trap and "Pigeon."

except towards the shooter, is strong, being made of all steel and iron, requires no screen, and it is impossible to tell which direction the ball will take. A small thumb-screw allows of the trap being set and used as a stationary one.

The balls, when first introduced, were merely of coloured glass; further improvements have chequered the balls, preventing the shot glancing off and filled them with feathers, rendering dispute as to their breaking an impossibility. Concrete and pitch balls have been introduced to supersede glass balls, the fragments of which are always unpleasant and often dangerous to have lying about; but they sometimes collapse with the weather, or are made soft, so that the shot penetrate but do not break them.

Bell-balls and explosive balls have also been tried with partial success, but all have been superseded by the Ligousky Clay Pigeon-Trap and Pigeons. The "pigeons," also termed mud saucers, are shown at G. They are very thin, concave below and convex above, and are skimmed from the trap with a most irregular flight.

The machine is upon a base, S, pinned to the ground, the horizontal direction of the flight is regulated by the paul B, the vertical, or inclination of flight, by the pins through the joints, C, D; the throw is effected by the coil-spring, cramped by the arm, E, brought into the trigger-catch, H; the pigeon is put in a finger-clamp at F, and strength of the throw by moving the catch H, into the notches on the quadrant N.

For officers in the army and sportsmen in summer months they offer a never-ending source of amusement; and for the benefit of clubs forming, and for use at friendly matches, we append the rules of Trap Ball Shooting, as compiled by Captain Bogardus and used throughout the United States, where it is now a national pastime, and has usurped the place of pigeon-shooting, which in several states is strictly prohibited by law on grounds of cruelty.

BOGARDUS' RULES FOR GLASS-BALL TRAP SHOOTING.

1.—All matches or sweepstakes shall be shot from three traps placed 10 yards apart, 18 yards rise, and the choice of traps to be decided by the referee, by drawing a gun-wad from his pocket and showing to trap-puller.

2. *Pulling of Traps.*—The trap-puller shall stand 6 feet behind the shooter. The traps shall be numbered 1, 2, and 3. The referee shall have three gun-wads; upon each a number corresponding to the trap. When the shooter is at the score to shoot, the referee will then draw a wad from his pocket and show it to trap-puller; the trap-puller will then say "Ready!" after which the shooter calls "Pull!" In all cases the puller must pull fair for each shooter. If the trap is sprung before the shooter has given the word, he can take the shot or not; but if he shoots, the ball or balls shall be scored whether broken or not, as the case may be.

3. *Referee.*—In all cases a referee shall be appointed, and his decision shall be final. In case the trap, when sprung, breaks the ball, the referee in all cases shall require the party to shoot at another ball, whether he shoots or not.

4. *Position at the Score.*—After a shooter has taken his place at the score, he shall not level his gun or raise the butt above the elbow until he calls "Pull." Should he infringe on this rule, the ball or balls shall be scored as lost, whether broken or not.

5.—All balls must be broken in the air to count; if shot on the ground, shall be scored as lost.

6.—There shall be no restriction as to size of shot used or charge of powder, but the charge of shot shall not exceed $1\frac{1}{4}$ oz., Dixon measure. Any one using larger quantity of shot shall forfeit all rights in the matches. After a gun is loaded and challenged, and the shooter discharges his gun, the penalty will be the same as for over-loading.

7.—All ties to be shot off at 21 yards rise, at five single balls each, and in case of second tie, five more balls, and so on until decided. In all cases ties must be shot off before sunset, or postponed until next day, unless the interested parties agree otherwise.

8.—In double shooting, the distance shall be 16 yards rise, and from two traps placed 10 yards apart. Ties shot off at 18 yards rise, at three pair balls each; and in case of second ties, three more pair each, and so on until decided. In all cases both traps must be sprung at the same time.

9. *Time at the Score.*—A participant in a match shall hold himself in readiness to come to the score when his name is called by the scorer. If he is longer than five minutes, it shall be discretionary with the referee whether he shall allow him to proceed further in the match or not.

10. *Miss-fire.*—Should gun miss-fire or fail to discharge from any cause, it shall score as a lost ball, unless the referee finds upon examination that the gun was properly loaded, and the miss-fire unavoidable, in which case he shall allow another ball.

11. *Loading Guns.*—In case of breech-loaders, the party called to the score shall not place his cartridge in the gun until he arrives at the score. In case of muzzle-loaders, the party called to the score shall not place the cap on his gun until he arrives at the score.

No one but a contestant has a right to challenge.

For reference, and the use of any gentleman who may be inclined to attempt to surpass the best shooting on record, we append a few of the most distinguished performances.

The quickest time recorded for breaking 100 glass balls with a shot gun is just under 5 minutes. Capt. H. Bogardus, the great American wing shot, made a match against time in December, 1879, and succeeded in breaking 5,500 glass balls in a few seconds less than 7 hours 20 minutes. The misses numbered 356. The Captain used an English gun with two pairs of barrels—one pair (10-bore) shooting 4 drachms of powder

and 1½ oz. of No. 8 shot; the 12-bore pair were loaded with 3½ drachms and 1 oz. of No. 8 shot. During the match the Captain loaded for himself, and changed the barrels no less than 55 times. Three miss-fires only occurred in the whole series of 5,855 shots. The balls were all sprung from spring traps. Professional marksmen with a rifle have found ball shooting an attractive feature of their programme. Previous to their introduction from America, the marksman was content to shoot at coins tossed in the air, or a few balls thrown up by hand or shot up with a catapult. Eighteen years ago a person named Troillet, in a match near Manchester, with a rifle hit six penny pieces in succession.

Dr. W. F. Carver, an American, and who spent sixteen years of his life amongst the Indian tribes, attained great skill with the rifle, and made his *début* in San Francisco as a professional marksman. About five years ago he visited Europe, and astonished all with his remarkable prowess. Coins, brickbats, glass balls, ends of boards, oranges thrown into the air, are hit by him with the greatest ease—in fact, his aim with the rifle is apparently unerring. His greatest feat was before the Prince of Wales at Sandringham Palace, when he broke 100 glass balls consecutively with his rifle. His quickest time for smashing 32 balls is 32 seconds. He broke with a rifle 5,500 glass balls in 8 hours, 7 minutes, 30 seconds, missing 712. His horseback, hip, and other fancy shots all betoken the same skill.

In a series of 25 matches at 100 clay pigeons each, between Dr. Carver and Bogardus, 2,227 were broken by Dr. Carver, and 2,103 by Bogardus at 18 yards. Dr. Carver made two scores of 100 each clear, and won 19 matches, tied in three, and lost three. His lowest score was the first (72); 20 of his scores exceeded 90 broken. Captain Bogardus' highest score was 99; his lowest (made thrice), 63.

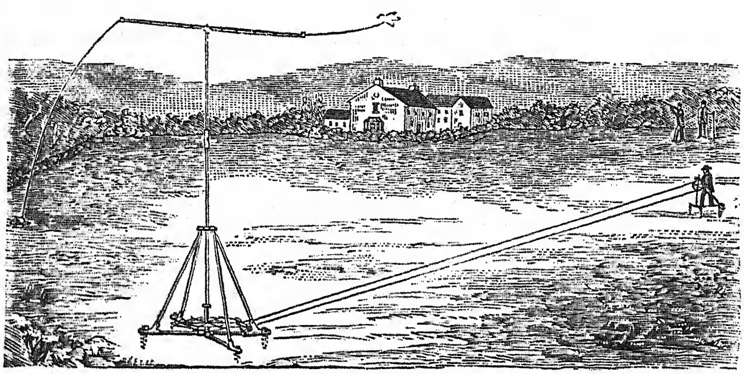
With a shot gun it is by no means difficult to make highest possible scores. Mr. Scott has broken seven consecutive hundreds without a miss. In a match between Dr. Carver and Mr. Scott, shot off in London in 1881, at 9,950 glass balls each, the scores were—Dr. Carver, 9,737; Mr. Scott, 9,735. Out of the last 950 Dr. Carver missed two only, Mr. Scott three.

With clay pigeons more skill is requisite, but breaks of 100 without a miss at 21 yards are by no means rare. Young Nimrod, previously referred to, with his 28-bore gun and ¾ oz. of shot, has frequently scored 88—100.

ARTIFICIAL FLYING PIGEON.

Messrs. Mansell and Bartlett have recently introduced a machine which the patentees think will supersede glass ball traps. The principle employed will be readily understood upon reference to illustration. A skilful driver is, however, necessary to get good sport from the birds; for if the driving-handle be turned slowly and regularly, a slow gentle sweep is given to the pigeon that no tyro could miss.

The pigeon is either of iron, whitewashed, or of a wire cage, having



Artificial Flying Pigeon.

inside an inflated india-rubber balloon, which keeps the two wings spread until caused to collapse by the penetration of the shots. Another pigeon with a balloon body is made which, when shot, falls to the ground.

Running ground game, deer, troopers, &c., are made upon the same principle. The whole apparatus is more difficult and expensive to maintain than ball traps, whilst the first cost is considerably heavier.

The Prince of Wales has, however, had one fitted up, and has expressed himself pleased with it.

BRITISH FIELD SPORTS.—DEER STALKING AND DRIVING.

"Awake and be stirring—the daylight's appearing
The wind's in the south, and the mountains are clearing ;
A thousand wild harts in the forest are feeding,
And many a hart before night shall be bleeding.
Make ready both rifles—the old and the new—
And sharpen the edge of the rusted skeene-dhu !
Let your telescope gleam in the rising sun ;
We'll have need of them all 'ere the day's work be done." LIDDELL.

There are three species of deer inhabiting the British Islands—the Red Deer (*Cervus Elaphus*), found wild in Scotland, the Hebrides, and a few of the wilder parts of Devon and Somerset in England, and the south-west of Ireland ; the Fallow Deer (*Cervus Dama*), is the dun deer of Robin Hood and the fat buck of pasty-loving friars ; it is only preserved in a semi-domesticated state, but most highly esteemed for the quality of its venison ; the third species is the Roe Deer (*Capreolus Dorcas*), looked upon by most farmers as vermin, and but little esteemed as venison, and seldom preserved.

The following is the correct nomenclature for the three species at various ages :—

AGE.	RED DEER.		FALLOW DEER.		ROE DEER.	
Years.	Male.	Female.	Male.	Female.	Male.	Female
1st	Calf.	Calf.	Fawn.	Fawn.	Kid.	Kid.
2nd	Brocket.	Hearot.	Pricket.	Pricket's sister	Girle.	Girle.
3rd	Spire.	Hind.	Sorrel.	Doe.	Hemuse.	Doe.
4th	Staggart.	,,	Sore.	,,	Buck of 1st Head.	,,
5th	Stag.	,,	Buck of 1st Head.	,,	Fair Roe Buck.	,,
6th	Warrantable Stag.	,,	Buck.	,,	,,	,,
7th	Hart.	,,	,,	,,	,,	,,

The harts and hinds are the only ones that are *stalked*, and although deer stalking is undoubtedly the first of British sports, it can be enjoyed by so few as to hardly come within the range of national sports.

The red deer is only stalked in the Highlands of Scotland. The forests of Athol, Sunderland, Corrichibah, Glenavon, Glenartney, Applecross, Gairloch and Gaick are the most extensive and best stocked, and in them

deer stalking is still carried on to that degree of perfection so well described in Mr. Scrope's renowned work on "The Art of Deer Stalking"—a book now rarely met with, but invaluable to the red deer stalker.

The deer forests are mostly in private hands, but occasionally second-rate ones may be rented.

The red deer attains the age of twenty years, and probably more if unmolested. Many fabulous accounts and legends assign to the hart much longer life than is assigned to man; it is rare, however, that a hart escapes many seasons, and seldom becomes grey with age. The over preservation of the red deer has caused them to degenerate, and much of their hardihood and gameness is being lost, besides which they are much smaller than formerly, though considerably more numerous. Mr. Scrope instances deer being shot weighing 30, 34, and even 36 stone (14 lbs.), whilst later accounts assign from 18 to 20 stone a fair weight for a fat hart.

The harts are "in grease" from August to the middle of October. At the commencement of the shooting season the harts keep together in companies; but on the approach of the rutting season—that is to say, the commencement of October—the finest harts will be found among the hinds. After the first few weeks' shooting, the harts become very wild; but later each lot of hinds contains a fine hart. Upon the harts going out of condition, the "yeld," or barren hinds, are in season, and are lawful game. No sportsman would wilfully shoot at a suckling hind; the barren ones are, however, distinguished by their sleeker appearance and lighter colour, though at times it is difficult to determine them. Ox-deer, or "heaviers," and rigs are in season with the yeld-hinds until the end of January; they may be distinguished from the hinds by their cropped ears.

The age of a deer is, for the most part, determined by the size and shape of the horns; the experienced forester can also tell by the "slot" or "spoor."

The horn is usually known as the *beam;* the width, the *span;* the projecting arms, *antlers;* a stag's brow antlers—bay and tray—are termed his *rights;* the upright points on the top of his horns are *crockets;* the rough base, *pearls.*

A *brocket* has only knobblers and small brow antlers; a *spire*, brow and uprights; a *staggart*, brow, tray, and uprights; a *warrantable stag* has brow, bay, tray, and two points on the top of both horns; a *royal* differs only in having an extra point on each horn.

After seven years it is difficult to determine the age at a distance; the older stags have, however, usually larger horns, with a *wider span* and more *bowed* than the younger ones. When stalking, it is not difficult to pick out a good hart, but in the excitement of a drive a quick eyesight will be necessary; for to shoot a staggart, brocket, suckling, hind or calf is unwarrantable, and though the best of shots sometimes kill them accidentally, it is seldom any one claims such after the drive.

Deer, when roused, invariably travel to windward, and if a north wind is blowing they will travel much farther when disturbed than with a south or south-westerly wind. The numerous corries or gullies that form the best haunts of the deer run in so many directions, and are connected with each other by so many passes, that none but a native gillie can tell in which direction a wind will blow up a certain corrie before the stalker reaches it. Gillies, or keepers, are therefore indispensable to successful stalking; and no sport, says Mr. John Colquhoun, in the "Moor and Loch," is more dependent upon the weather.

"The most propitious day for deer-stalking is a cloudy one, with blinks of sunshine, exactly such as you would choose for fishing. When the sky is cloudless, and the sun very dazzling, the herd are apt to see you at a great distance, and take alarm. High and changing wind is always bad, as it keeps them moving about in a wild, uneasy state. In such weather it is better, if possible, to wait till it settles a little, and take advantage of the first calm. If the breeze be light, they will not move much, but a strong, steady wind lasting for days will always make the deer change their ground by facing it often for miles. Mist is the worst of all, as the deer are pretty sure to *see you* before *you* see *them*. Always advance on deer from above, as they are much less apt to look up than down a hill. If possible, have the sun at *your back* and in *their* face. With this advantage you may even venture to approach from below. If it is a quiet spot, and the sun is at your back, wait for a clear blink before making your near approach. Never stalk between two herds, if it can be helped; this is always considered bad stalking."

Besides these remarks, we can do nothing beyond recommending the sportsman in every case to take the advice of the chief forester, as being possessed of more local knowledge, and more adept at woodcraft than any occasional stalker is likely to be.

The great point in deer shooting is to keep cool and motionless when near the deer. The first sight of "the antlered monarch of the waste" will cause what the Americans call "buck fever," even to the coolest rifle shot; but unless of a very nervous temperament, it will wear off after a few misses.

At a running deer, presenting the broadside, there is no shot so effective as that point just behind the shoulder, and if the deer be allowed to go two points past the shooter before firing, the bullet will probably reach the heart—an important point, for the deer is most tenacious of life, and although mortally wounded will often distance his pursuers. The son of the author once shot a fallow buck whilst running across a pass about 120 yards distant, and although its heart was literally "blown out" with the ·450 Express bullet, it managed to keep up with the herd nearly 30 yards, and after staggering a little further rolled over dead. Another one shot whilst *standing*, with a Lord Keanes' expanding bullet, started with the herd and ran 25 yards, although the bullet grazed the lower part of the heart. Indeed, if struck fair, a buck will generally manage to run 10 or 15 yards before falling; if, however, it drop instantly, it may regain its feet and escape. If shot through the head, neck, or spine, it generally falls forward; when through the heart, it falls on to its side, or rears up and falls over backwards. If struck too far backward, in the paunch, a deer will run for half-a-day, and often be lost, though dying in the course of a day or so.

It sometimes happens that a deer cannot be shot in the side without injuring a hind, or another in close proximity to it; this is often the case when shooting harts in October. In such cases, the head affords the best shot, the vital part lying between the eye and the ear, or immediately below and a little behind the ear. Amongst a herd of bucks, at the commencement of the season, some of the finest will often move their heads from among the closely-packed mass of horns, and afford the stalker a good head or neck shot. If at close range, the middle of the neck should be aimed at; but it is a risky shot, as, unless the jugular vein or the spinal vertebra be severed, few dogs can bring the deer to bay, and in hot weather, as often experienced in July and August, a hart that has been chased never affords eatable venison.

A double rifle is best for deer-stalking. The Express, of ·450 or ·500 bore, is the handiest and most effective at ranges up to 200 yards; it is however, objected to by some on account of its spoiling the venison. The bullets must be hardened, to prevent them flying to pieces inside the deer. The Lord Keanes' expanding bullet, although very effective in stopping the deer at once, often spoils the whole side of venison. Solid bullets, both conical and spherical, are therefore often chosen in preference to Express bullets.

DEER DRIVING.

"Ye shall be set at such a tryst,
That hart and hind shall come to your fyst."

SQUYER OF LOWE DEGREE.

There are two kinds of deer driving practised—one that can fairly claim to be legitimate sport, the other being simply a *battue*. The first is when, ostensibly deer stalking, the sportsman is placed near some pass or deer run, whilst the foresters and gillies attempt, by giving the deer wind and halloaing, to cause them to take that particular pass.

It often happens that, owing to the numerous passes from the corries, it can never be determined which one the deer will take. In this case the sportsman gains the ridge of some hill, where he may be seen by the drivers, who take their station at the foot, and by various signs whilst driving indicate the direction taken by the deer. The sportsman, in accordance with the signal from below, must hasten from "snib" to "snib," and often severe and exciting exertions will have to be made before obtaining a fair shot at the deer.

The grand *battues* have a most imposing and exhilarating effect, as so many friends can participate in the sport.

The deer are driven to a certain pass in the forest near which the sportsmen lie in ambush. A large number of keepers, shepherds, and hillmen then drive all the herds of deer within a certain radius towards that pass. Drives are often difficult to accomplish successfully, owing to it being necessary to drive the deer with the wind, whilst instinct prompts them to always run against it. The first few deer are allowed to go past the sportsmen, as, if the leaders were killed the whole herd would turn, when nothing could possibly prevent them breaking through the line of drivers. A double rifle is best for this sport, and as all the shooting will be at running deer, the side shot must be taken. The sportsman must by no means be flurried; for no honour is gained by wounding a deer, or killing hinds and calves.

HUNTING THE ROE-DEER.

The roe-deer, on account of its destructive habits, is by many land-owners shown no quarter, and as by most sportsmen it is supposed to be always in season, it is pursued to extermination.

Roes, however, are in season in the same way as every other deer—the season being in winter, from November to the end of February, being at their best the latter half of December. A fine roe at this season makes better venison than either red or fallow deer; but when not in the pride of their grease their flesh is so much carrion.

Roe-bucks are occasionally stalked with the ·360 Express rifle; but except for would-be deer stalkers the sport has no attractions, being a mere burlesque of red-deer stalking. The roe-deer may be hunted by putting a couple of good fox or bloodhounds, or experienced dogs, into a covert on a still day, so that the baying of the hound may be distinctly heard, and that no gusts of wind shall carry the hunter's scent to the deer. The hunter must post himself upon a good pass, and follow the hound as fast as he can, when it gives voice. The buck usually dodges about round hillocks, and the sportsman, by getting near the hillock unobserved, can seldom fail of getting a shot.

A good 12-bore gun, with buck shot three to the layer, will be found the most effective—weight being a consideration—as when following the hound it is often a mere matter of wind and strength. The coverts may also be beaten by some dozen or more men and dogs, and the sportsmen placed so as to command all the favourite runs; but although a more easy method, it does not afford nearly so much sport.

GROUSE SHOOTING.

No sport is more keenly enjoyed by its devotees than that to be had "among the blooming heather," at the Red Grouse.

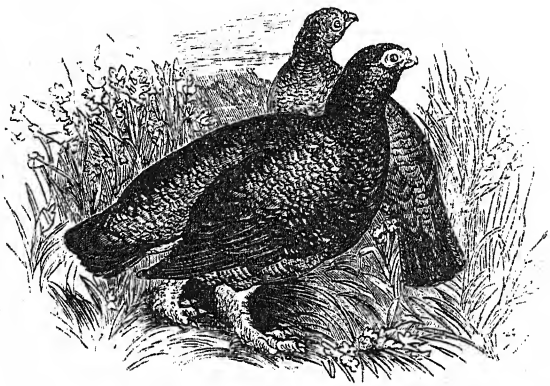
The Red Grouse (*Tetrao Scoticus*) is a variety of the *Tetraonidæ*, limited to the British Islands, and is found alike upon English and Irish moors, and the Welsh and Scotch mountains. In Scotland are likewise found Ptarmigan (*Lagopus Albus*) and Black Grouse (*Tetrao Tetrix*). The Capercailzie, which became extinct in these islands about the middle of the eighteenth century, was re-introduced into Scotland about 1835, and has thriven well.

It is a noticeable fact, however, that black grouse succeed in driving the red grouse from a moor or district; whilst they, in their turn, have to give way to the Capercailzie.

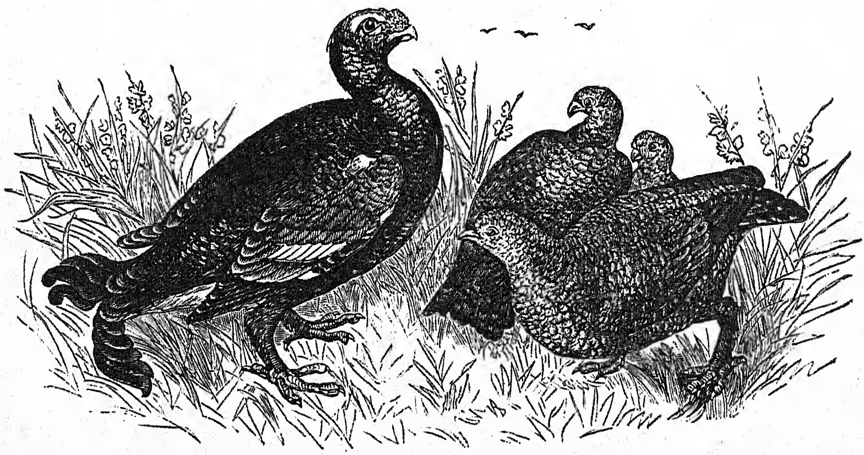
The Ptarmigan,

> "Haunter of the herbless peak,
> Habitant 'twixt earth and sky,"

seldom comes under the notice of ordinary sportsmen, and is scarce, even in the Northern and Western Highlands, although more plentiful in the Hebrides, Orkneys, and Shetlands.



The Red Grouse (*Tetrao Scoticus*).



The Black Grouse (*Tetrao Tetrix*).

Ptarmigan shooting, as a sport, is tame; but the scenery coming to the view of all who stalk the Ptarmigan, "sitting in his home sublime," well

rewards the true lovers of nature. They are sluggish birds, lying remarkably close, with bad scent for dogs, and take short flights, circling in a small curve. The colour resembles the peaks they frequent, and in winter their plumage is white.

Capercailzie are not sufficiently numerous as to rank amongst British game; a short account of shooting them and the Ptarmigan is, however, given in "Shooting Notes for Scandinavia."

The Black Grouse, better known to the sportsman as the Black-cock, and the females the Grey-hen, is chiefly confined to North Britain; considerable quantities exist, however, in some of the southern and midland counties. The shooting commences the 20th of August, in which month they are more easily approached than any other feathered game; whilst in the winter few are more difficult to get within range.

The hen and chicks are generally easily enough got at; but the old cock, who marches about alone, or with a dozen antiquarians of his own sort, and always on the *qui vive,* is a most wary bird, and affords much sport.

Black grouse are often met with in stubble to which they will make long flights; whilst the red grouse seldom strays from its favourite heather.

The red grouse season commences August 12th; and, for the first few weeks, good bags can be generally made by walking the moors with dogs; setters have the preference.

Next to deer-stalking, no British sport is more exhilarating, or proves harder work, than walking the moors after grouse. We will give a few hints; but must refer the reader to the "Moor and Loch" for minute instructions as to grouse shooting.

Grouse are apt to fly with the wind, often long distances, scudding along close to the heather, and, when settling afar off, are only discernible by the flapping of their wings. The grouse are more easily approached from below than above, and more easily found in the morning and evening than mid-day, when, if sultry, they lie quite still.

To range a moor, the best plan is to commence at the outskirts, give the dogs the wind, and endeavour to drive all the birds towards some spot near the centre, where, at evening, if the day has been favourable, good sport should be had at the remnants of the packs congregated in the patch of reserved ground. To be successful, the skirmishing must be thoroughly carried out, and the reserved centre carefully beaten with a brace of fresh and

experienced dogs. Alternate patches of old and young heather is the most likely ground for grouse; freshly-burnt heather, or rank, luxurious, unvarying crops of the same, seldom cover many birds. It is useless to commence grouse shooting too early in the morning; the evening is the best time. Later in the season, the "packs," which are generally large and very wild, must be broken before the birds will lie. The best way is to drop the leader at the first chance. Always cross the dog a good way ahead when he points; and, towards the close of the season, a full-choke-bore, such as used for shore shooting, is the best weapon for grouse. During August and September, the ordinary 12-gauge, if well choked, is sufficiently large to secure good bags.

Grouse driving is now largely practised, the sportsmen being stationed at several parts of the moors, hidden by "blinds" of peat stacks, furze, &c. The beaters then endeavour to drive the various packs within range; the whole success depending on the skill of the drivers, the nerve of the shooters, and the weather. Occasionally great slaughter is effected. The largest bags we enumerate at the close of "British Shooting Notes."

PARTRIDGE SHOOTING.

Partridge shooting in England is justly considered the chief field sport; first, because it is more generally pursued, and, taking one thing with another, it gives the most enjoyment.

Partridges, of which there are two kinds well known to the English sportsman, are found in all the English and Welsh counties; the eastern are the more plentifully stocked, especially Norfolk, which is, without doubt, the best preserved and well stocked county in Britain.

The partridge belongs to the order *Tetraonidæ*, and is known to naturalists by the name of *Perdrix cinerea*, or the grey or ash-coloured partridge; Craven and Byron, however, call the bird the nut-brown partridge. The red-legged, or French partridge (*Cacabis rufa*), belongs to the same family of the *Tetraonidæ* as the common grey partridge, but is inferior to it both for sport and flavour, though of larger size. This variety, which is found all over Southern Europe, was introduced some seventy years ago into England from the Channel Islands. Although first reared in Norfolk and Suffolk only, the birds propagated so rapidly that

they quickly extended throughout England, to a considerable extent ousting the common partridge. The red-legged partridge is the abomination of sportsmen, on account of its propensity for running, and the difficulty experienced in getting it to rise. The partridge, strange to say, invariably thrives best upon cultivated land, the petty plots of the numerous French landowners, and the market gardens of Essex and Surrey, are often plentifully stocked with partridges.

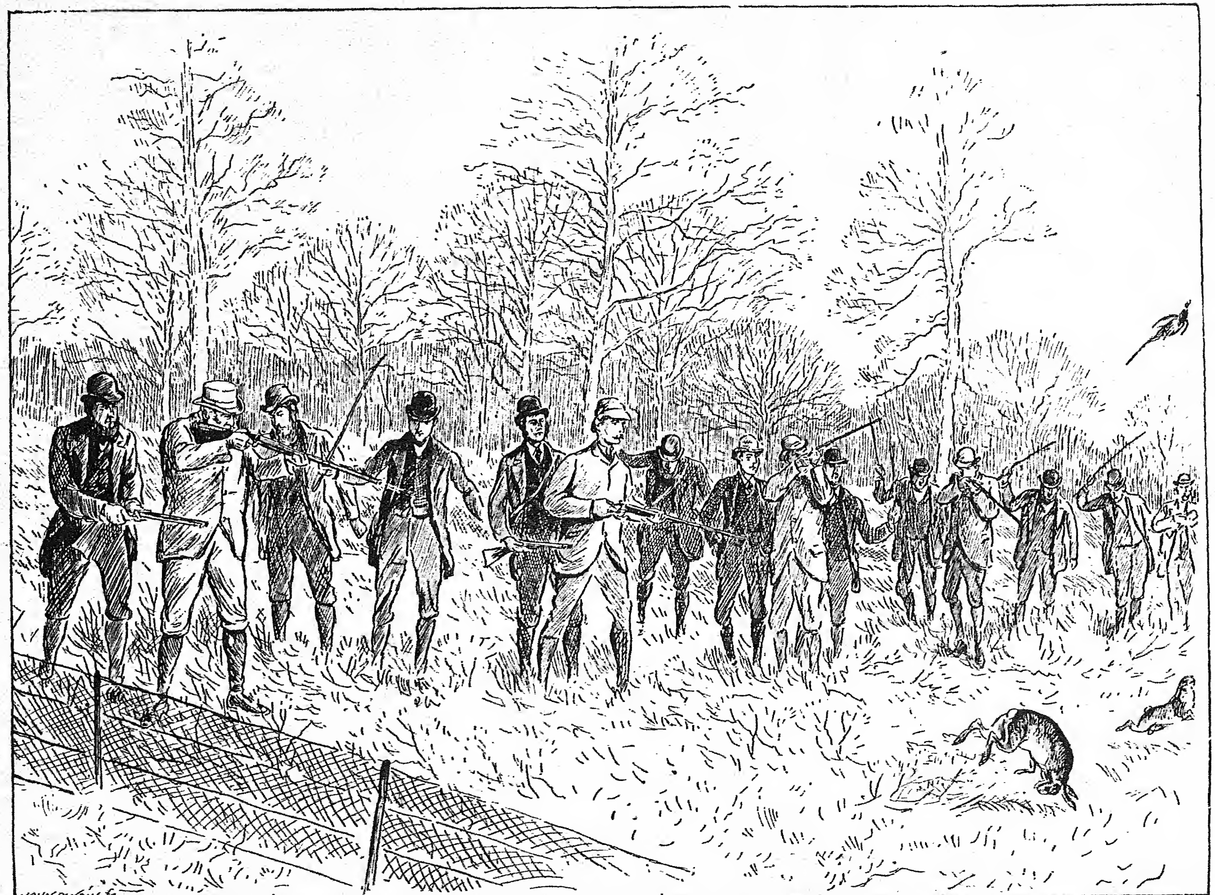
Arable land is usually better stocked than any other, though furze-covers, ferns, and patches of cole-seed are excellent harbours for partridges; but, as a rule, stubble and turnips will be found to contain the most birds.

At the commencement of the season the birds are seldom wild, and lie close, especially amongst turnips in a heavy rain, and upon days preceding a storm. Towards December, the birds, if much shot at, become wild, and the best chance of getting within range is to pass rapidly from one turnip field to another.

The partridge season commences on 1st September, and is looked forward to by the generality of sportsmen with joyous expectation. It is doubtful, however, whether it would not be preferable to have the *ouverture* fixed, as in France, by some local potentate; as birds in the southern counties are often in condition for shooting several weeks before those of the north, whilst some years the shooting would be greatly benefited by being delayed for a few weeks. Many indeed will not shoot partridges until October, and others contend that in November they are unfit for food. In many quarters, however, good sport can be obtained as late as January, and birds in December are often at their finest, though much depends upon the weather.

Sportsmen will do well not to shoot very late in the season, as the partridge pairs early, and to shoot a fine bird near home in January may prove bad economy. The most sportsmanlike manner to shoot partridges is with a brace of dogs; but, unless at the commencement of the season, or in exceptional cases, large bags are not obtained in this way.

When shooting over dogs, the sportsmen enter the stubbles, attended by one or two good markers, and proceed to walk the ground, taking care to beat up wind, and if possible towards a piece of turnips, potatoes, seed-clover, or other cover likely to hold the birds when they leave the stubble. The ground must be well traversed and wide-ranging avoided.



The Royal Party Shooting at Combe Wood.

In the morning the birds will be found sunning themselves on banks, &c. It is unnecessary to commence partridge shooting before nine o'clock, as they will not lie close until the dew has disappeared. In the mid-day, fallows and grass fields are favourite resorts, the coveys in the evening usually returning to the feeding ground they left, or were flushed from, in the early morning.

Kites are sometimes flown over covers into which partridge have been driven, in order to make them lie close. If the kite, which is shaped to resemble a large hawk, is flown with judgment and skill, and the coveys scattered, the birds rise singly and may easily be bagged.

The fashionable mode of partridge shooting is by driving. A number of beaters are employed, who drive the partridges into the turnips or suitable cover.

About eleven o'clock the sportsmen, five or more in number, form a line and enter the turnips. The shooters are distant thirty or forty yards from each other, and one or two beaters should be stationed between each shooter to ensure the ground being properly traversed, the birds lying very close in high turnips. As the birds rise they are shot at by the shooter in front of whom they rise; should they cross before another shooter, either before or after they have been shot at by the one in front of whom they rose, he may shoot at them, but it would be breach of etiquette to shoot at a bird rising before another shooter.

Dogs are only used to retrieve, and usually the gathering of the birds is left to the beaters, and the coveys are not followed up as in ordinary partridge shooting; but the turnips are sometimes walked a second time.

In shooting at coveys, always pick an outside bird, and never fire into the thick or "brown" of the covey; to do so is cruel, unsportsmanlike, and often futile.

PHEASANT SHOOTING.

Two varieties of the Pheasant are known to English sportsmen—the common pheasant (*Phasianus colchicus*), and the ring-necked smaller variety (*Phasianus torquatus*). Both are chiefly propagated by breeding in confinement and hand-rearing. The cock pheasant is polygamous, thus the shooting of hen pheasants is avoided, and in many places a fine is imposed upon the luckless sportsman who is so hasty and careless as to destroy one. Pheasant shooting is of two kinds—working a cover with *well-broken*

spaniels, and by *battue*. The former, although by far the most sportsman-like method, is little practised now, although perhaps no sport affords more pleasure than beating a cover with a team of carefully-trained spaniels.

Pheasants in a wild state often, indeed usually, breed in one covert, and feed near another. The sportsman wishing to find them at the commencement of the season, before the coverts are leafless, will do well to search the more open spinnies and double quick-lines adjacent. Fields of uncut beans, barley, clover, and tares in the vicinity of the coverts also hold the birds well during the first month in the season, and make the sport available without tearing through the copse and brushwood, and tramping the almost impenetrable mass of briars.

Pheasant shooting cannot well be carried out in the coverts as long as the leaves remain thickly on the trees; so that from the opening of the season (October 1st) to November, pheasant shooting is best practised in the open.

Battues are conducted in different ways, the one most in favour being to surround the plantation with a net three or four feet in height, unless the covert is enclosed by a wall. This prevents the pheasants from running, as they are apt to do. At ten or eleven the guns arrive, and the sportsmen placed in advantageous positions, commanding all the open spaces; thus, even in large coverts, a dozen shooters will get shots at nearly every living thing in the covert. All being "posted," the "beating" commences, the "driving" being accomplished before the arrival of sportsmen. A pair of guns are generally employed by each, and the sportsman furnished with an attendant to load.

The luncheon invariably forms an agreeable break in the day's proceedings, after which the best coverts are drawn; and if in a hot corner, and the sportsman keeps calm, or is an adept at covert shooting, the quantity that may be bagged will exceed more than six days' legitimate sport, and cause greater fatigue than even walking the moors. But ordinary sportsmen, so placed, can seldom tell what they shoot, how they shot it, or who shot at the same instant, after or before themselves, and, feeling in constant peril from some careless or over-excited neighbour, wish themselves well out of it.

The "hot corner" is the subject of our frontispiece; and the Duke is bringing down his birds with the calmness of a veteran *battue* shooter.

SHOOTING GROUND GAME.

The hare (*Lepus timidus*) and the common rabbit (*L. cuniculus*) are both common throughout the British Islands. The Alpine hare is likewise to be found in considerable quantities in the Highlands.

Although hares are, by some coursers, looked upon as sacred to beagles, greyhounds and harriers, most believe that they come within the legitimate use of the gun; and the Ground Game Bill of 1880 extends the privilege of shooting or destroying hares to every land proprietor and tenant-farmer.

A hare is generally an easy shot, although, when driven in covert, his squeal and rush are somewhat bewildering. The young sportsman must, however, aim at the tips of the ears of a running hare, and well in advance when "puss" is slinking away amongst mangels or turnips. Hares prefer lying on a "form" to remaining in covert; bare fallows are favourite places to make the form; and the hare invariably lies head to wind. Driving is sometimes practised in Scotland; but in England it is only driven with other covert game.

Notwithstanding the Ground Game Act—which, we trust, has been forgotten by those it was meant to benefit—hares are more plentiful all over England this season than they have been any year in the last decade.

Rabbit shooting, for affording sport, depends almost entirely upon the manner in which it is conducted. The most enjoyable is to hunt the rabbits out of the coverts with dogs; this is best done in February, when the rabbits lie above ground. They may also be hunted out of gorse or brushwood in the same manner, the sportsmen stationing themselves so as to command the open ground. Shooting over ferrets is very tame, especially when the ferrets lay up in the holes continually. Hedgerows, likewise, may be hunted for rabbits with tolerable success, the sportsmen being on each side of the hedge, but making it a rule never to fire until the rabbits leave hedge and bank and take to the open.

WOODCOCK SHOOTING.

The Woodcock (*Scolopax rusticola*) is acknowledged to be the most difficult of English birds to shoot. This arises from the thick coverts he haunts, and the rapid swerves he makes when rising. Few birds breed in

Britain, the majority arriving in October and leaving in March, November being the month *par excellence* for Woodcock shooting.

In the south of England it is useless to look for Woodcock except in covert; in the north, long heather is equally as successful to beat. In heather they usually frequent the shady side, but in the large woodlands with plenty of brushwood they lie on the sunny side.

When flushed, the Woodcock makes a rapid, swerving, but usually short flight. Should he leave covert and take to heather or underwood, he may again be flushed with perhaps success; but afterwards it is useless to follow, as his flight always increases in distance as it is successively flushed. But with Grouse, Partridges, and most other birds the reverse is the case, so that a strong man by continued walking may frequently tire a pack; with Woodcock such an attempt is useless.

The evergreens of a plantation often hold Woodcocks better than other trees, and it is a peculiarity of the Woodcock that he is never entangled in his rise, or at a loss for a second as to what course he shall take. As a rule, he drops near a roadway or open space, or, if in a thicket, there is always a free, clear passage above him.

Woodcock in covert not too thick may be shot over spaniels, but the favourite way is to beat the coverts. The men keep line and strike the trees with long wands. Markers conveniently posted add considerably to the success of the sport.

A thaw after a long frost is the worst weather for Woodcock shooting, and stormy, windy weather not good, the birds taking to the lee side of a knoll upon the least indication of rough weather. Except in their migrations, they fly usually head to wind, like Snipe.

Quick shooting is generally but not always required in Woodcock shooting—indeed, the flight is so variable that no set rules can be given for guidance, and no game bird flies more quickly.

> "Where woodcocks dodge, there distance knows no laws,
> Necessity admits no room for pause."

Short barrelled guns are best for Woodcock, and No. 6 or 7 shot is generally used.

The Woodcock is renowned for gastronomic virtues, is in bad condition

Woodcock Shooting.

in hard frosts, but rapidly improves—indeed, it is said a Woodcock will fatten in a few hours on proper food.

The usual weight is from nine to twelve ounces, and there is little difference in size between the hens and cocks; the former are, if anything, the larger.

SNIPE SHOOTING.

> "There's a twofold sweetness in double pipes;
> And a double barrel and double Snipes
> Give the sportsman a duplicate pleasure."
>
> HOOD.

Snipe are to be found more or less plentifully in nearly all the marshes and fens of the world. Several varieties visit the British Islands, but one only, the common Snipe (*Scolopax gallinago*) breeds here in any quantity.

The Jack Snipe (*S. gallinula*) seldom breeds in England, but comes over about the middle of September, and leaves in April; it is not nearly so numerous as the common Snipe, but much more so than the Double Snipe (*S. major*), which is seldom met with far from the eastern coast.

There is also the Summer Snipe (or common Sandpiper), the Green Sandpiper, and the Black Snipe (*S. sabini*) to be occasionally met with.

The many bogs, marshes, and uncultivated lands in Ireland make that country one of the finest for Snipe; Lincolnshire, Essex, Sussex are also famous for Snipe ground.

In September and October, if the weather be mild, the Snipe is more often found on high ground; but when the sharp frosts of November commence, the marshes, and especially those near the sea, or well sheltered, are the favourite haunts of the Snipe.

For Snipe shooting, setters are preferable, and a good retriever broken to water is necessary.

Snipe almost invariably fly head to wind, and for the first twenty or thirty yards after rising, their flight is most erratic, a zigzag course being taken at a great speed. The sportsman will do best, if the bird rises at thirty or forty yards, to shoot almost before it commences flying; if rising within ten yards or so, to wait until it has got a good distance, and settled to a steady even flight, before firing. The ground is usually beaten *down*

wind; hence dogs with good noses are necessary to success, but they may be greatly assisted by allowing them to beat *across* the ground repeatedly.

The 12-bore full-choke is the best gun for Snipe, with No. 7 or 8 chilled shot.

MISCELLANEOUS SHOOTING.

Besides the game already mentioned, there are many birds occasionally met with in Britain that cannot be properly classified as *game*, or included with "Wild fowl." The most important of these is the Quail (*Perdrix coturnix*), often called the Wandering Quail, and much prized by sportsmen.

Quails arrive in this country towards the latter end of April, and leave generally in October. They are most plentiful in the south and eastern counties, and are seldom seen in any quantity north of the Tweed.

The Quail lies close, flies quickly straight and low, affording very good sport; and although of small size (from 3 to 5 oz.), its appearance at a season when other game is scarce makes it very welcome.

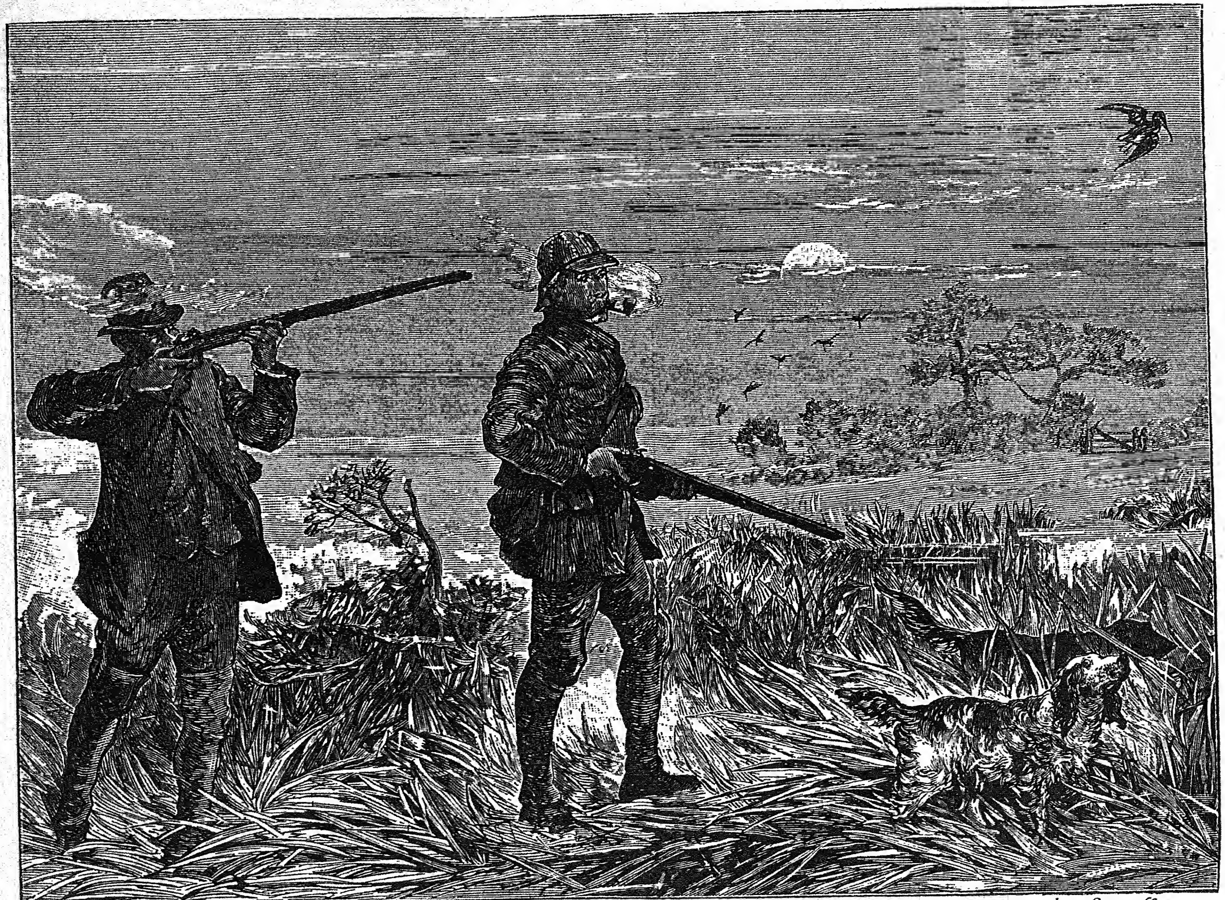
Quail often winter and breed in England, and several attempts have been made, with fair success, to increase the number breeding in this country, by turning down in suitable districts.

Other birds frequenting partridge ground are the Landrail, Spotted and Little Crake, the Great, Grey, and the Golden Plover, the Dotterel, the Peewit.

The Landrail, or Corn-crake, is a summer migrant, appearing about May and leaving in September. Shady, moist localities are best adapted to its habits. Clover, meadow-land, vetches, buck-wheat and oats generally contain them. In Ireland they are particularly numerous; also in the island of Anglesea, Caithness in Scotland, and in England are most plentiful in districts visited by Quails, and the grass counties.

As a game bird the Landrail is of little worth, being difficult to flush and slow and heavy in its flight; its flesh is, however, highly esteemed.

The Great or Norfolk Plover, or Stone Curlew (*Œdienemus crepitans*), is likewise a summer visitor, arriving in April and leaving in September. As its name indicates, it is common in Norfolk, but Suffolk, Essex, Kent, Cambridge, Hampshire, and most of the south-eastern counties are frequented by it. The sandy plains of the first-named county are, however,



Snipe Shooting in the Marshes.

its favourite haunts; large unenclosed fields, heaths, and warrens likewise suit its habits. It is difficult to approach, and a full-choke with large shot (No. 4) will be found necessary.

The Grey Plover (*Squatarola Helvetica*) is very plentiful in Ireland, but scarce in England—Hampshire being the best county. The Grey Plover is gregarious, associating chiefly with the Lapwing or the Golden Plover. It generally arrives in October and leaves about March. In open weather it feeds in ploughed fields; in frosty weather it seeks similar ground near the sea-coast.

On taking to the wing, the Grey Plover commences by towering, and then descending, and sweeping within a few feet of the ground. Whilst performing these gyrations he is easily shot.

The Golden, Green, or Yellow Plover (*Charadrius pluvialis*) is a resident amongst us all the year, and is highly esteemed by *gourmands*. In autumn they associate in flocks and fly southwards, the heaths, downs, and large open fields being their favourite resorts; but they can generally be found in open weather wherever their favourite food, worms, abounds.

Secluded marshes and water meadows are good places to look for the Golden Plover, but they generally keep a good gunshot distance beyond danger; and when on the ground straggle in a manner bewildering to the shooter. When on the wing few birds keep better together; they are, therefore, often treated as wild-fowl, and "potted" wholesale by stanchion guns.

The Dotterel (*Ch. morinellus*) is not at all plentiful in the British Islands. They breed chiefly in the high lands of Yorks., Derby, and Lancashire; also in Scotland. They are rarely seen in the West of England or Scotland, but visit the south and eastern counties of England towards the end of April. Their stay is, however, short. The flight of the Dotterel is similar to that of other Plover, and they may be easily shot or netted. Open ground and fallows are their favourite resorts when not breeding.

The Peewit or Lapwing (*Vanellus cristatus*), is by no means a sure bird, but frequents nearly all open partridge-ground. Undrained and marshy land is, however, best suited to this bird, whose habits are partly maritime.

It is to be found all over the British Islands; the best places to seek it

being boggy or wet pasture-land, low, moist meadows, fenny ground, and sub-alpine moors. Wherever such ground can be found on the coast or inland the Peewit may be found. They are very difficult birds to approach, but if partridges are scarce it affords good sport to stalk them.

The Cushat, Ringdove, Wood-pigeon, or Quest is to be found in nearly all the coverts of the United Kingdom. Although not occupying the prominent position it once did amongst sportsmen, it is sought after by many, and as a test for a gun's penetrating powers it is without an equal. In the autumn they frequent the corn-fields and hedgerow trees, when they may easily be shot. By hiding near the plantation in which they roost, and waiting their return at sunset, large numbers are killed.

Rook-shooting as a sport is tame; but coming at a time when other shooting is scarce, it is welcomed by many sportsmen in order to keep themselves in form. If the small rifles made expressly for Rook-shooting are used, considerable skill is called for to drop a Rook perched on a *swinging* bough, and for tyros the practice cannot fail to prove beneficial.

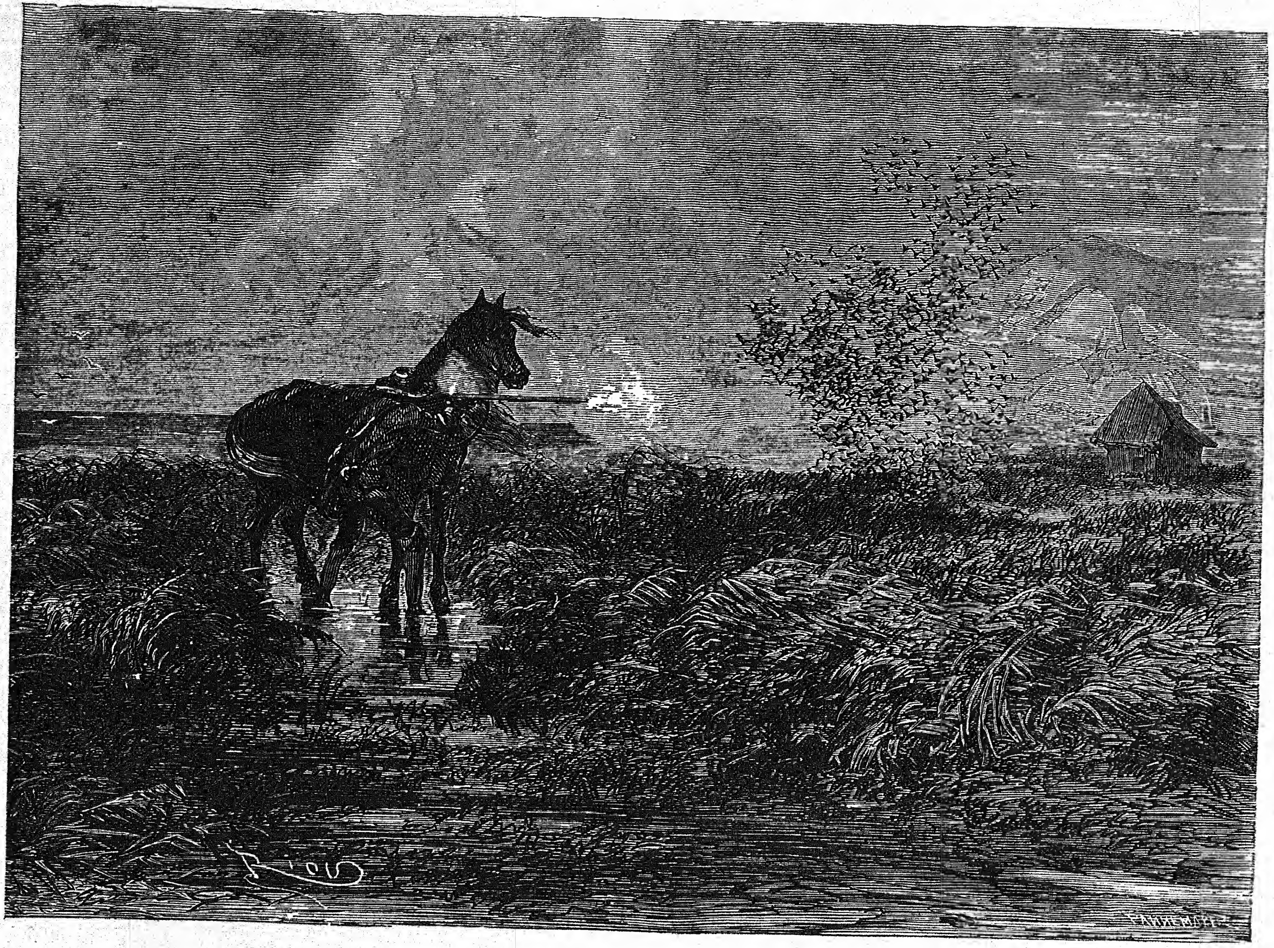
WILD-FOWLING.

Wild-fowling may be classified as consisting of two kinds of shooting—fen and shore shooting, and punting. The first named has been practised in Britain from time immemorial; and for this purpose the gun was early used in England. The *modus operandi* of taking the fowl was necessarily different to many now employed; but the following, as old as the hills, if not practised to-day, will be recollected by many sportsmen: nets, springs, lime-strings, gins, pitfalls, pipes, and poisoned grain. Chaucer makes mention of the call and net—

> "Lo, the birde is begyled with the merry voice of the fowler's
> Whistle, when itt is closed in your nett."

The inhabitants of Lincolnshire, Cambridgeshire, Norfolk, Essex and Huntingdon have always been well supplied with migratory birds; and these counties are still amongst the best for wild-fowling; but the many lochs of Scotland, and the bogs and marshes of Ireland, rival them in the quantity of game, if not in the variety.

Wild fowl shooting is principally practised during the winter months, and can never be considered a comfortable or easy sport. The engraving



The Stalking Horse.

of the Stalking-horse will convey some idea of the ground in which fen shooting has to be pursued. The Stalking-horse, one of the most ancient devices of the wild fowler, is, on account of the trouble in training and keeping, seldom employed. An imitation beast, made of painted canvas stretched on a lath frame, in which two shooters may conceal themselves, has been substituted for the living animal.

The art of modern wild fowling has been the topic of so many practical sporting authors, that, beyond a mere list of the birds to be constantly met with, and their approximate seasons, we shall not endeavour to treat of the vast subject; successful wild fowling being in itself the study of a lifetime. The shore and fen shooter will, doubtless, make his first acquaintance with wild fowl by shooting the Wild Mallard and Duck (*Anas boschas*). The young ones take to the water soon after being hatched, and are termed "flappers"; the month best adapted for their shooting being the latter half of July. Although scarcely able to fly, they are shot on account of their delicacy for the purposes of the table. Widgeon are of next importance; they are migrants, arriving in September or October, and leaving towards the end of March. The Teal, although the smallest of British ducks, is highly esteemed by the wild fowler and epicure on account of its delicious flesh. It is, for the most part, migratory, few breeding in England. The time of its arrival and departure is the same as that of the Widgeon. In its flight, although rapid, it is steady, so that a good shot rarely can miss. The Moor-hen, or Gallinule, is a common bird on inland waters, and very few of our rivers or ponds are not graced by its presence. It swims and runs most rapidly, and is an adept at diving, but has not sufficient power to fly quickly or far. A similar bird, but rarely met, on account of its retiring habits, is the Water-rail. The Moor-hen is said to be the connecting link between the Rail and Coot family; and their wings being so little formed for flight, they afford poor sport to the crack shot.

The Common Coot (*Fulica atra*), also called the Bald Coot, is often met with on inland waters and the coast, the creeks of Essex and Hants being continuously visited by it. The Coot affords poor sport, and is not highly esteemed in England for the table.

The birds already mentioned, with Pintailed Ducks, Grebes and Dunbirds, Plover, Ruffs and Reeves, form the common game of the fen shooter;

Duck Shooting from a Boat.

most of them are also to be found on the sea shore, or visit it in hard, frosty weather. The following birds, however, are rarely seen inland.

The Wild Swan, or Hooper, now a rare visitor to these islands; but, doubtless, a severe winter would greatly increase the number migrating southward from their breeding-places in the Arctic Ocean. Several varieties of the Swan are amongst the visitors; and, until continually harassed by punters and wild-fowlers in general, they are easily approached and killed, if struck in the head or under the wing; even swan shot will fail to penetrate the thick armour of down and feathers protecting the breast, body, and wings. A Swan is considered a rare prize by the punter, and is but rarely brought to bag by shore shooters.

Of the Goose family, the Wild Goose, or Greylag (*Anser ferus*), the Bean Goose (*A. segetum*), the White-fronted Goose (*A. erythropus*), the Bernicle Goose (*Bernicla leucopsis*), and the Brent Goose (*B. Brenta*), are amongst the regular visitors. The first-named makes excursions inland to feeding-grounds, but is so wary that it can seldom be approached when on the feed, and flies out of range when passing to and from the coast. The Bernicle Goose appears on our western coast in large flocks during severe winters. It is smaller and more shy than the *Anser ferus*, and is consequently most difficult to get within range.

The Brent Goose is the smallest and most numerous of the Geese frequenting our coasts, and in severe winters it is to be found in large flocks in most of our creeks and bays.

The Curlew (*Numenius arquata*) is a frequent inhabitant of northern Scotland, its European range being northward. It is a noisy, pugnacious bird, and its shrill whistle is perhaps better known to wild-fowlers than that of any other shore birds. It breeds inland, but resorts to the coast in the cold season.

The Whimbrel (*N. pheopus*) is not at all common in England, being essentially an Arctic bird; in the Scottish Islands, Orkneys, &c., it is common enough, and is said to breed there.

The Duck family met with on the coast comprise, amongst others, the Sheldrake, Ruddy Sheldrake, Eider, Long-tailed, Harlequin, Scaup, Tufted and Garganey Ducks. There are also the Shovellers, Gadwalls, black and velvet Scoters, Golden Eyes, Morillons, and the numerous divers

of the *Colymbas* family, and every kind of sea-fowl, from Guillemots to the Sea Eagle.

The best gun for wild-fowling is one that will shoot effectually the larger-sized shots. Seldom anything less than No. 4 shot is used, and long shots are the rule ; it is therefore expedient to have a full-choke and not smaller than 10-gauge. If the wild-fowler is strong, and his sport lies chiefly on the shore, a double 8-bore will be more effective ; and if a sailing boat is employed to take the shooters, as is generally the case in the Scotch lochs, firths, and most of the English estuaries, an 8-gauge may be comfortably employed ; but unless a sportsman of exceptional physique, we should not advise an 8-bore for shooting on shore, or boggy and fenny marshes. If very large birds are expected, and a sailing boat takes the sportsman to the flock, a 4-bore is undoubtedly a great advantage, as it throws the largest-sized shot so regularly, and has a much larger killing circle. In this case it is as well to take a smaller gun or "cripple-stopper," to economise ammunition and save the constant firing of so large a weapon, which generally causes headache in the course of a day's shooting, if fired continuously.

PUNTING.

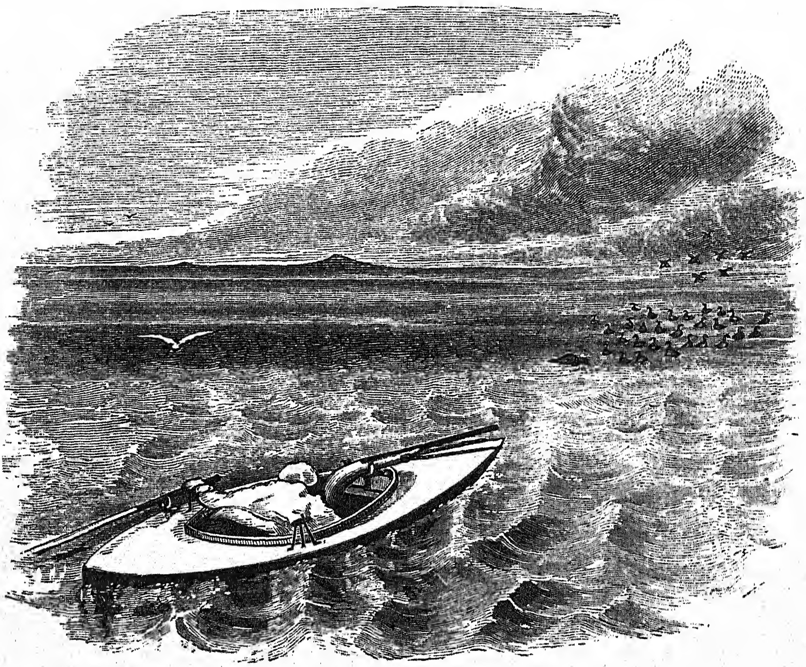
Punting, or marine wild-fowl shooting, consists of circumventing flocks of birds when floating on the water, and firing into their midst, immediately they rise, from a pound to a pound and a half of shot, the object being to kill as many at one shot as possible. The boat used to "stalk" the flocks of fowl is a shallow, flat-bottomed, uncomfortable craft, termed a "punt," and, as "Craven" facetiously remarks, "resembles nothing so much as a pig-trough." Punts may be single or double-handed—that is to say, constructed to carry one or two puntsmen, in addition to the gun and accessories.

The varieties of punt-guns we have already described at some length, and we have now only to offer a few general remarks upon punting.

The amateur puntsman cannot do better than put himself into the hands of a professional, and employ a double punt ; the guide providing most of the necessaries and doing the hardest work. By the time he is sufficiently experienced to take out a single punt, he will know more than it is possible to gain from books.

The gun, lying along the deck of the punt to starboard of the mast, is aimed with one hand and discharged with the other. It is best to have the gun so shipped as to throw all the recoil upon the breeching or swivel. Professional puntsmen still adhere to the manilla rope breeching, as here shown.

To such, Greener's "recoil toggle" offers many advantages. It consists of a short tube, piston and rod, to which the rope breeching is made fast.



Punting to Wild-fowl.

The toggle resembles, and is upon the principle of, the common "spring balance," india-rubber being, however, substituted for the coil springs. It is needless to say that it is immaterial to which end of the breeching the "recoil toggle" is affixed; the one next to the gun has, however, the preference.

It being the desire of puntsmen to pot as many birds as possible by one shot, and always aiming into "the brown" of the flock, punt-guns are not required to shoot close, the main object being a large killing circle. We

have tried them at various ranges with the usual charges, and find that for closeness of pattern they are a little superior to a full-choked 4-bore gun with $2\frac{3}{4}$ ounces of shot, whilst the pattern is pretty equally distributed over a target six feet square; there is very little difference in the closeness of pattern at eighty or a hundred yards.

Doubtless, by applying the choke-bore system to punt-guns, their range, penetration and closeness of pattern could be greatly increased—indeed, it is possible to change a punt-gun into a choke or cylinder at will, by a modification of Ropers' principle of choke-boring.

This, as we have described in the history of choke-boring, consists of a choked muzzle-piece screwed on to the nose of the barrel. For shoulder-guns the system is unsuitable *in toto*, but for punt-guns we make use of the same principle: the muzzle-piece screwing on with a large key or "spanner," the thread on the barrel being protected by a brass ferule when the choked muzzle is not in use. The ferule may be exchanged for the muzzle in a few minutes, but it cannot be accomplished whilst afloat.

The number of birds killed at one shot greatly varies; from sixteen to thirty is the general thing, two dozen being considered a fair average shot. Instances are on record, however, of over one hundred ducks being killed at one shot. It is seldom shots are fired from punts at a greater distance than 100 yards, a good puntsman being able, in favourable weather, to stalk within that distance. Small sailing yachts, from five to eight tons, are frequently used for wild-fowl shooting; sailing down the rivers and estuaries with a crew of two or more, and firing either a punt or large shoulder-gun as sport may offer. Night time is best adapted for punt-shooting, providing the atmosphere be clear, and the flocks can usually be approached 20 yards closer than in daylight. Cripple-stoppers, or small shoulder-guns, for despatching the wounded, are always carried, and are usually cheap 12-bore guns, strongly but plainly made for rough wear.

Most of the English creeks, bays, estuaries and tidal rivers are haunted by various wild-fowl, and resident or wandering puntsmen. The eastern and southern coasts are the most thronged. Scotland is also *visited* by amateurs, and the many rivers of Ireland are frequently traversed by the now ubiquitous wild-fowler.

Wild-fowl shooting abroad will be noticed under the headings of the various countries.

In all kinds of wild-fowl shooting it is good policy never to shoot the birds before or whilst on the feed. After feeding, the birds may be shot, and those escaping will return to the same feeding-ground; whereas, if shot at before feeding, the flocks will desert the ground for an indefinite period, if indeed they ever return. The wild-fowler's and sportsman's terms for companies of various birds are as under:—

Of Swans, a "herd."
Of Geese, a "gaggle," when on the water.
" a "string" or "skein," when flying.
Of Ducks, a "paddling," on water.
" a "team," on wing.
Of Widgeon (according to the quantity), a "company," "bunch," "trip," or "knob."
Of Dunbirds, a "flight," or "rush."
Of Teal, a "spring."
Of Divers, a "dopping."
Of Coots, a "covert."
Of Curlews, a "herd."
Of Herons, a "sedge."
Of Plover, a "wing."
Of Lapwings, a "desert."
Of Snipes, a "walk," or "wisp."
Of Ruffs, a "nill."
Of Mallards, a "sord."
Of Sheldrakes, a "dopping."
Of Pheasants, a "nide."
Of Grouse, a "pack."
Of Partridges, a "covey."

CLOSE SEASON FOR GAME AND WILD BIRDS IN BRITAIN.

Until the last few years, the close season, or period in which it is forbidden to destroy game, has been the cause of endless confusion. The repeal of certain Acts, and substitution of others more simple, has fixed one time as the close season for all wild birds (upwards of eighty varieties are specified in the schedule), from the 1st of March to the 1st of August. This Act came into force the 1st of January, 1881. The seasons for *killing* game in the three divisions of the United Kingdom are as follows:—

KINDS OF GAME.	ENGLAND & WALES.		SCOTLAND.		IRELAND.	
	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.
Grouse, or Moor Fowl	Aug. 12	Dec. 10	Aug. 12	Dec. 10	Aug. 12	Dec. 10
Black Game, or Heath Fowl	Aug. 20*	Dec. 10	Aug. 20	Dec. 10	Aug. 20	Dec.
Ptarmigan	..	..	Aug. 12	Dec. 10	..	..
Partridge	Sept. 1	Feb. 1	Sept. 1	Feb. 1	Sept. 20	Jan. 10
Pheasant	Oct. 1	Feb. 1	Oct. 1	Feb. 1	Oct. 1	Feb. 1
Quail	As Wild	Birds.	As Wild	Birds.	Sept. 20	Jan. 10
Landrail	ditto.	ditto.	ditto.	ditto.	Sept. 20	Jan. 10
Hare	No close	season.	No close	season.	April 20	Aug. 12
Male Fallow Deer	ditto.	ditto.	ditto.	ditto.	June 10	Sept. 29
Other Male Deer	ditto.	ditto.	ditto.	ditto.	June 10	Dec. 31
Wild-fowl and other birds, not game	Aug. 1	March 1	Aug. 1	March 1	Aug. 1	March 1

* Except in Somerset, Devon, and the New Forest, where the commencement of black-game shooting is deferred until Sept. 1.

It will be observed that no protection is afforded to deer, either in England, Wales or Scotland, and in Ireland to the males only. The Irish law came into force in 1698, and accords eight months close time to fallow bucks and six to others; hinds and does may *legally* be shot at any season.

LARGE BAGS.

Perhaps few topics afford more discussion amongst the shooting community than the subject of large bags, and different persons hold different opinions respecting them, according to each one's ideal as to what constitutes good sport. Without wishing in any way to take one side or the other, we append a few notes on the largest bags that have been made, as we believe every one will like to be accurately informed as to the largest bags recorded.

Battue shooting, a Continental fashion, has, of course, resulted in large bags, and rearing and preserving have to be more strictly persevered in, to keep up the average quantity of game.

Game on the Continent must, however, have been common enough in the eighteenth century, as the following clipping from an old journal will prove :—

> "In 1788, a party of ten persons at the château of Prince Adam Daversperg, in Bohemia, who were out *five hours* on the 9th and 10th of September, allowed that the first day 6,168 shots were fired, and 876 hares, 259 pheasants, 362 partridges, besides quails, rabbits, hawks, &c., were bagged, or rather waggoned. On the second day 5,904 shots were discharged, and 181 hares, 634 pheasants, and 736 partridges were killed; in addition to these, in the evening of the second day were picked up 42 hares, 75 pheasants, and 103 partridges, which could not be immediately found in the bustle of the business. We are further informed that no peculiar mode was adopted to drive together such a quantity of game."

"Craven," in the *Sporting Magazine* for October, 1845, gives an account of six days' shooting he had at that time in Germany. He says a party of a dozen killed, near the Hartz Mountains, in three days' shooting, 13 deer, 56 roes, 10 foxes, and 327 hares; and at a shooting party in the plains of Magdeburg, in four days' shooting, no less than 2,400 hares were bagged.

The late King of Naples is said to have killed, at different times, in Austria, Bohemia, and Moravia, 5 bears, 1,820 wild boars, 1,968 stags, 13 wolves, 354 foxes, 15,350 pheasants, 1,121 rabbits, 16,354 hares, 1,625 she-

goats, 1,625 roebucks, and 12,435 partridges—in all 52,670 head of game.

In 1755 a hunting party, of which the King of France made one, chased in Bohemia for eighteen days; there were but thirty-three persons in the party, and eight were ladies. Spears, hawks, &c., were employed, as well as guns, but the result of the chase was the bagging of 47,950 head of game and deer, viz.:—19 stags, 10 foxes, 18,243 hares, 19,545 partridges, 9,499 pheasants, 114 larks, 353 quails, and 454 other birds. The Princess Charlotte fired 9,010 shots, the King 1,798 shots, the rest of the party making up the number of shots to 16,209.

To return to our own country. About twenty-five years ago, Mr. Campbell, of Monzies, N.B., having driven all the grouse into a first-rate beat, sallied forth at daylight with five muzzle-loading guns and a sufficient quota of keepers and watchers, and succeeded in bagging 220 grouse by evening; every "squeaker" was, however, counted.

Lord Walsingham, on the 28th of August, 1872, at Bluberhouse, in Yorks., killed 842 grouse in one day to his own gun. This is the largest bag on record.

The next is that of Mr. F. A. Millbank, M.P., a week before that of Lord Walsingham's, and in the same county. The bag, the result of eight drives, was 364 brace; and Mr. Millbank's party, varying from five to nine in number, succeeded in bagging in six days, commencing August 20, no less than 3,983½ brace, or nearly 8,000 birds. Mr. Millbank's score for the six days, including the 364 brace bagged the first day, was 1,099½ brace.

The largest bag made over dogs was by the Maharajah Dhuleep Singh, at Grantully, Perthshire, on the 12th of August, 1871. His Highness used three guns, and only one pair of dogs working at a time. He commenced at five o'clock, and continued until late in the afternoon. The result was 220 brace of grouse. His Highness has likewise made the largest bag of partridges—namely, 780 birds, hand-reared; this was made at Hall Farm, Griswell, on the 8th of September, 1876. The birds were hand-reared and driven, and were bagged with a little more than 1,000 cartridges being fired.

Several large bags at both grouse and partridge were made in the seasons of 1881 and 1882, but up to the present Lord Walsingham still heads the list. A memorial stone has been laid by Lady Millbank on the moor where Mr. F. A. Millbank has so often made large bags.

FOREIGN SHOOTING NOTES.

INTRODUCTION.

IN compiling the following notes, every care has been taken to ensure accuracy, and in no one case has the author the slightest doubt as to the reliability of the information so liberally given to him. Due allowance must, however, be made for the varying stages of water and growth of feed, which, altering almost every season, cause game to move continuously, so that no locality can be determined upon for any length of time in advance. Especially is this the case in our rapidly-growing colonies, in the United States, and Brazil, which are fast settling up.

The notes have been brought down to the latest possible date—most of them as late as 1880; and the author, whilst thanking his numerous friends for the aid given on an almost inexhaustive subject, desires particularly to remember Dr. E. Azzi, of Milan; Mr. H. R. P. Carter ("Smoothbore"), of Madras, and Mr. S. Runnicles, of Ibraila.

Mr. J. W. Long, who contributed the major portion of the shooting notes to the United States, has, we regret to say, passed away from the scene of the sports he so enthusiastically advocated.

Mr. F. Carter, mention of whom is made in the shooting notes on Africa, is also dead, having been murdered by blacks whilst in charge of the Belgian exploring party.

The alphabetical arrangement of the countries in each quarter of the globe has for the most part been followed. In the division of Oceania, British possessions have the preference; and the author has thought it best to devote a special note to "Sport in the Arctic Regions."

A table, enabling the sportsman to ascertain without trouble the import duties upon guns, &c., into each country is added; and an article upon the best countries and districts to obtain particular species of game, and advice to sportsmen seeking sport abroad.

ARCTIC SPORT.

In the summer months a yachting cruise for sport may advantageously be made, either to Baffin's Bay or Lapland.

If for the first-mentioned, the best time to leave is about the end of May, and steam to *Disco* in Danish Greenland, reached in four weeks. On Disco Island, and on the mainland at a short distance from the settlement, there is plenty of game—Ducks, Seal, Walruses, and a few Deer. Steaming along the coast near Pröven, "Looms," are to be seen in myriads. Cockburn Island will give good sport, but if Cape York is passed, and a small bay called Port Foulke made (lat. 78 deg. 20 N.), it will afford excellent anchorage for eight or ten weeks, and is an unequalled centre for sport. Excursions may be made in its vicinity after the Musk-ox *(Bos Moschatus)* Reindeer, Hares, Foxes, Bears, Walruses and Seals. Sea-fowl of all kinds are numerous, including Ducks, Auks, Dovekies, Looms, Rotjes, and others barely classified.

It will be daylight almost the whole time, so that sport can be carried on without intermission.

The outfit should include a whale boat and harpoon gun, Express Rifles and 10-bore shot guns.

In an easterly cruise during the summer or autumn, there is little chance of Walrus until rounding Cape North, and there it will only be found on ice-floes. Walrus-hunters start annually from Tromsö, and coast along Novaiya Zemlya and Siberia, as far as Cape Taiymir. Sometimes great success is met with, at others sport is indifferent. Reindeer, Polar Bears, Foxes, Swans, Geese, Ducks, Ptarmigan, and many other birds are plentiful along the coast of Lapland and the borders of the White Sea, but this trip is not likely to prove so successful for sport as that to Baffin's Bay. An Express Rifle and a 10-bore shot gun will be equal to the sport, unless Walrus-hunting is determined upon.

AUSTRIA.

Several of the provinces of the Austro-Hungarian Empire are amongst the best-stocked hunting-grounds of Europe. *Transylvania* is certainly the best; Hungary, Bohemia, Tyrol and Carniola are also first-class resorts for shooting. In the year 1878 nearly 1,100,000 head of game and wild animals were destroyed in Bohemia alone.

Transylvania is at present seldom visited by sportsmen, or even the ubiquitous tourist. As a country for sport it is to be highly commended, but the sportsman must be prepared to rough it, and be furnished with letters of introduction to at least one Magyar nobleman. He will find the people hospitable to all English, and ready to show the sport of the country at its best; and although the sauer-kraut and sausages may not be relished, the variety of the shooting will more than counterbalance that and lesser evils.

The Bos Auroch, or European Bison, is said to linger in the north-eastern Carpathians. Bears, Red-deer, Chamois, Roe-deer, Steinbock, or Ibex, Bustards, Capercailzie, Black-cock, Grouse, Red-legged Partridges, Quail, Ptarmigan, Snipe, Woodcock and Wild-fowl, are all abundant in their localities.

There is good sport near Klausenberg and Hermanstadt, but if a trip is taken to the mountains, the party must try camping out in the wilds. Not only will good sport be gained, but the same pleasure will be experienced as afforded by a trip to the Adirondacks, or the Llano Estacado. The best time to visit Transylvania is from August to November. The winters are very severe, and the summers very hot; arms and ammunition must be taken from England, and a permit obtained at the Consulate in London before starting. Except at Vienna and Budapest, no good gunpowder or shot can be obtained in Austria, and in many of the towns powder of any description cannot be bought.

A rifle of ·450-bore will be best for Chamois, Bears, Deer, Wolves; and a 12-bore gun will answer well for the other game. A good knife should not be forgotten, and it is well to take a saddle if Hungary or Transylvania is to be visited.

In Bohemia game is plentiful, but strictly preserved. Sportsmen with good letters of introduction may get good sport on almost any of the preserves, and most sporting requisites can be obtained at Prague.

The shooting of the Tyrol is mainly Chamois-hunting, and to gain success in this sport the hunter must be a first-rate mountaineer, as well as a keen sportsman. It is usual when Chamois-hunting to leave the town or village in the valley, ascend the mountain in company with the forester on the overnight, sleep at one of the shepherds' châlets on the mountain, and devote the next day to sport. Much has been written in praise of Chamois-

hunting, and to those who delight in hard work, beautiful scenery and mountain life, no doubt it is most attractive.

The generality of sportsmen are, however, indifferent mountaineers, and there are but few who could keep a steady aim in the awkward and dangerous positions that almost daily occur in Chamois-hunting.

Game being strictly preserved in Austria, the sportsman must be guided as to locality by his letters of introduction; and in Styria, *Carniola*, Goritz, Salzburg or the Tyrol, he will get good sport at Red and Roe-deer, Capercailzie, Black-cock, Hares, Partridges, &c., as well as Chamois-hunting. We know of no place in any of the above-mentioned provinces where a sportsman could obtain shooting by lease, or in any other way, unless he has friends in the country.

BELGIUM.

Sportsmen going to Belgium should obtain, through the Belgian Consulate in London, a permit to take in their guns and ammunition. This will cost only Consul's fees, and save bother on the frontier. A license to kill game must be taken; its cost differs in the various provinces, but about 37 francs is the rule.

Luxembourg is perhaps the best province for game, and there and in eastern Liège, the forests cover Red and Fallow Deer, Wild Boars, Roebucks, Hazel-hens (*Tetrao bonasia*), "Coq-de-bouleau" (*Tetrao tetrix*), Red-legged Partridges, and other small game.

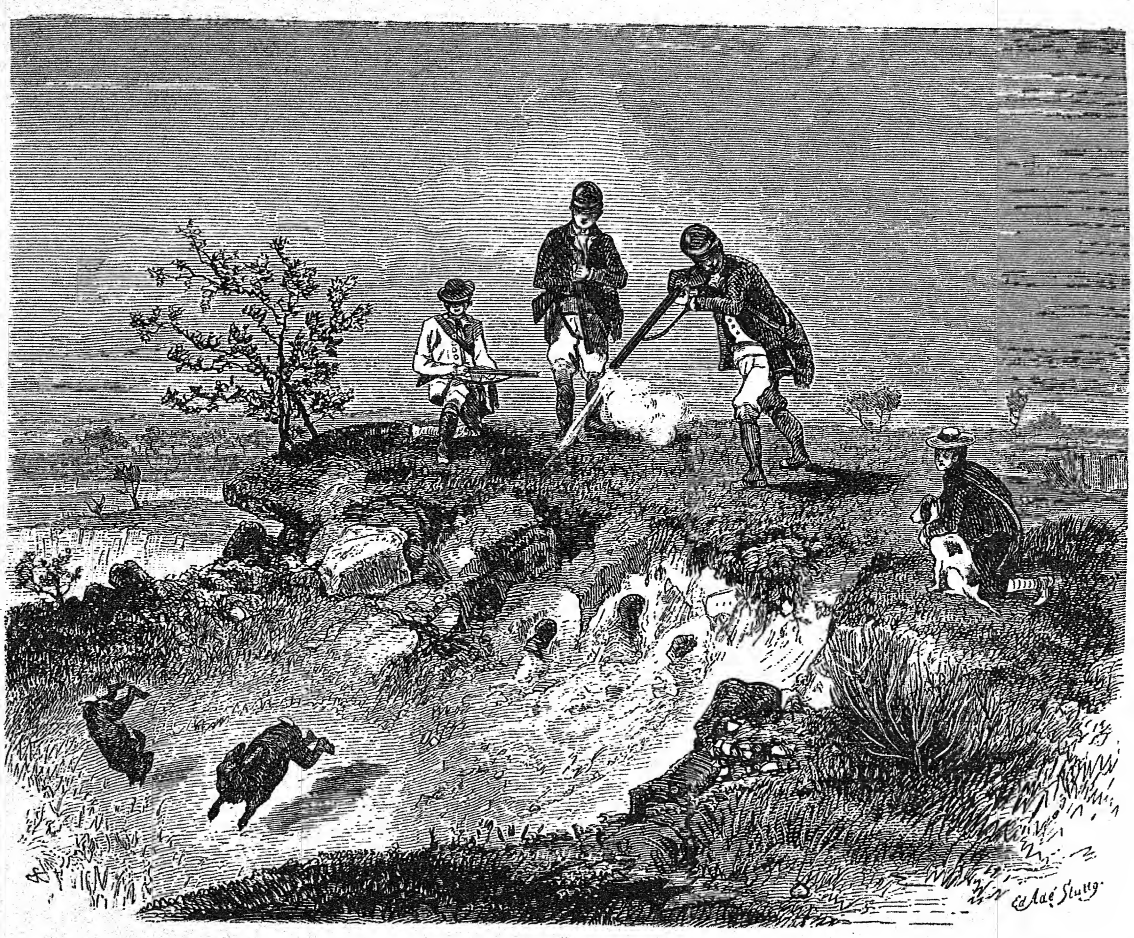
In Namur and Hainault are Pheasants, Hares, and Roe-deer. Hares and Partridges are very abundant on all the plains, and Quail in season.

Anvers and Flanders are well resorted to by water-fowl of many kinds. Snipe and Woodcock are also plentiful in these two provinces. The marshes of Limbourg are also frequented with like game.

Sea-fowl innumerable on the coast of Flanders, within easy distance of Ostend; there are, however, restrictions as to punts and stanchion guns.

Rabbits are to be found in great quantities throughout Belgium; Brabant, Hainault and *Namur* affording abundance of this sport.

The Rabbits are netted, trapped and shot. The shooting is frequently done over ferrets, as in England.



Rabbit-shooting in Belgium.

DENMARK, ICELAND, AND FAROE.

In Denmark there is little game to be found, and none worth visiting the country for.

Hares are fairly numerous, and Pigeons in the woods on the hills, and a few Partridges. The landowners, however, carefully preserve all for their own use.

Wild-fowl are to be shot in great numbers in Sjealand, Anholt, Lesso and Bornholm about September and October, when the birds are migrating from the Baltic; but beyond this, and fishing, which is very good, there is little sport in Denmark.

In Iceland the natural wonders and the varied game attract many English visitors during the summer. The tourist or sportsman should leave Leith by steamer not earlier than May, or later than August. The necessaries will be gun and ammunition, riding-saddle with crupper, and snaffle bridle. The only large game in the island is Reindeer. These are divided into two herds—one, the smaller, ranging in the north-east in the *Myvatnsöraefi* district; the other between *Hafnarfjörda* and *Krysnvik* in the south-east. There are Seals round the coast, but the pursuit is hazardous and uncertain. Foxes and small fur-bearing animals are in plenty, but in summer their skins are worthless.

Of birds, Ptarmigan, Whimbrel, Plover and Snipe are plentiful, and sea and wild-fowl innumerable. Any one who may feel disposed to brave an Icelandic winter would get fair sport at Reindeer, Seals, and in May probably at Polar Bears. These visitors come on the ice-floes from Greenland, and are usually found on the north-western shore. The Blue and the White Fox, besides several other valuable fur-bearing animals, could be trapped in any quantity during the winter, if all necessary articles were taken from England. As it is, however, the sportsman is compelled to quit Iceland just as the best shooting is coming on. Fishing is very good throughout Iceland.

THE FAROE ISLANDS.

These islands, belonging to Denmark, lie on the route of steamers from Leith to Iceland.

The chief islands are Stromsoe, Osteroe, Suderoe, Waagoe, Sandoe, and

Bordoe. Thorshavn, the capital and chief port, is in direct communication with steamers from Leith. Messrs. G. V. Turnbull and Co. are the agents. The islands afford very good shooting and are well worth a visit, and sportsmen going to Iceland may advantageously spend a few weeks on them if they care for wild shooting and fishing.

Waagoe, lying a good way to the south, is but seldom visited, and is consequently the best shooting-ground. The game to be had consists of the Mountain Hare, Plover, Snipe, Whimbrel, Oyster-catchers, Cormorants, Puffins, Dottrel, and sea-fowl innumerable.

The sportsman, however, must take care not to shoot the Eider-duck, which is strictly preserved for its down. Near Thorshavn, the best shooting is on a plateau on the south side of the island.

Snipe and Oyster-catchers are the most numerous birds next to sea-fowl, and are found on all the islands. To yachtsmen the islands offer many advantages, and the small Whale (*Phœna melas*), or "bottle-nosed," visits the islands in large schools. The local name is the "Grind" Whale, and the average from 6 to 10 feet in length. A yacht carrying a harpoon gun might have very good sport amongst these animals. The best month is August, but in June, July or September their visits can generally be relied upon. To naturalists the islands offer many attractions—none certainly so near the British Isles are so rich in ornithology.

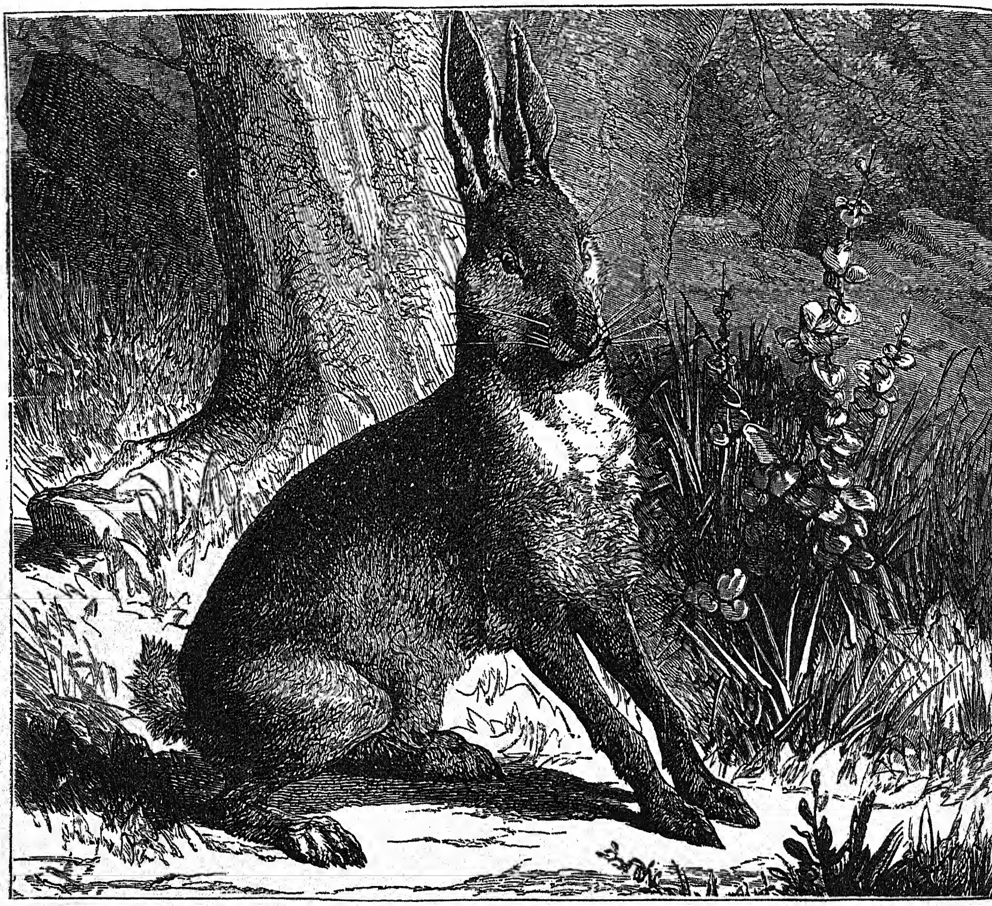
No. 4 and No. 8 shot are most required. There are no import duties, and living is very cheap; but leave for shooting must be obtained, as in some places shooting is not allowed on the score of it disturbing the Eider-ducks. English is generally understood by officials, also German and French. Danish is the national tongue. Dogs are a great nuisance, and only useful for Snipe-shooting, the best grounds for which are on Borderoe and Waagoe.

FRANCE.

Of late years the French, like the Americans, have made shooting their grand passion. The game is well preserved in the close seasons, but the shooting is free to the landowners who have a *permit de chasse*, or *port d'armes*, which the visitor also must possess before he can legally shoot game. It costs 25 francs, and gives the right of shooting over all crown lands at any kind of game; but in each Commune where the shooting

is done a further 5 francs will have to be paid to the *Maire de la Commune.*

In France the opening and closing of the shooting season varies in the different localities, it being regulated by the Prèfet of the Department.



The Hare (*Lepus Timidus*).

In April Duck-shooting commences; afterwards the passage birds, Snipe, and Woodcock.

Towards the end of August the season for Deer, Boars, Roe-deer, Larks, Quail, Partridges, Pheasants and Hares commences. The season usually closes towards the end of January.

At all times of the year the Prèfet may give permission to shoot Rabbits, Wolves, Boars, and other destructive game.

France being so highly cultivated, game is not very plentiful, especially the large game; but the Deer (*Cervus elaphus*) is to be found in some of the large forests, though in most cases it is strictly preserved. The Fallow Deer (*Dama vulgaris*), once very common in France, is now found domesticated in the parks of the nobility. and a few in some of the larger forests.

The Roe-deer (*Cervus Capreolus*) is indigenous to France, and is found in the brushwood on the borders of the forests, and in all the well-wooded parts of France, but more especially the hilly districts. They are shot usually *en battue*, either with shot-guns and No. 1 shot, or small Express rifles, the former preferable.

The Chamois (*Antilope Rupicapra*) is found on the mountains bordering France; in the Jura mountains there are a few, and on the Alps they are more plentiful.

The Wild Boar (*Sus Scrofa*) inhabits all the low-lying large forests of France. He is stalked at night, or a battue organised in much the same way as in Germany, which see.

Wolves in some districts are numerous; they should never be spared, as of late years they have proved very destructive to game, and a bounty has been placed upon each head brought in.

The Fox is plentiful in France, and is shot or trapped, as fox-shooting is not sufficiently practised to keep down the ravages.

Badgers, Otters and Wild Cats are numerous in France, but they are only hunted as vermin. Formerly Otter-hunting was practised, but it has been discontinued.

Hares are found generally throughout the north and centre of France, similar to ours; in the south of France they are smaller.

Rabbits are plentiful throughout France, and landowners have the right to kill them at any time.

The following is a list of the forests in which large game is more frequently found: in L'Oise, Halatte, and Ennenonville; in Seine Inférieure,

The Sportsman of the Landes.

La Londe, Rouvray, Roumaire, Vert Trait and Brotonne; in L'Orne, Le Perche, Audaine, La Trappe and Bonmoulins; in Calvados, Cerisy and Saint-Lever; in Côtes du Nord, Soudeac and Lorges; in Loire Inférieure, Gaire; in Eastern France—Barrois, Rheims, Abbeville, Chaume et L'Arc, &c.; in the centre—Beaumont-le-Roger, Villon, Blois, Russy, Citeaux, Conches, &c.

In France undoubtedly the best shooting is at the Wild-fowl. The north and western coasts, but more particularly the latter, abound with Water-fowl, whilst on the shore of the Mediterranean Coots are very numerous. The best localities lie around the mouths of the Rhône, and the lagoons in Hérault between Montpellier and Agde.

In Western France, in the marshes or "landes" lying between La Rochelle and Biarritz, good sport may be had, it being only necessary to pay five francs to the Maire de la Commune. The native sportsmen of the Landes usually shoot on stilts, as illustrated. The stilts are strapped to the leg, and the sportsman takes the game from his retriever with a long-handled fork.

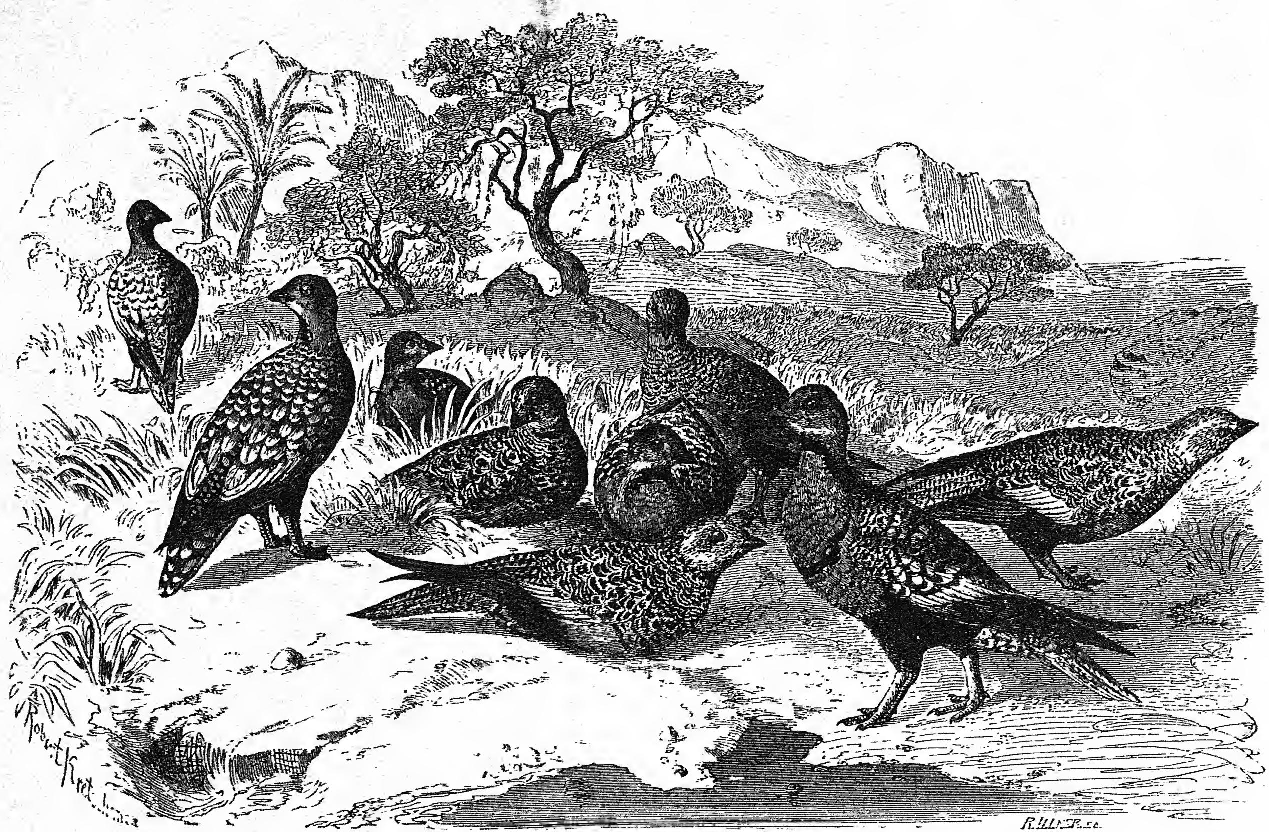
The sportsman visiting France can, during the early autumn, depend upon having fair sport at Quails. These birds are some years exceedingly plentiful in the southern and central districts, and, together with Hares and Red-legged Partridges, constitute the chief game of France.

The forests of the Ardennes are amongst the best in France for Deer and Wild Boar shooting. The eastern provinces are also well stocked with large game.

In the Riviera there is no shooting worthy the name. On the coast west of Marseilles there is fair shore-shooting. In the provinces at the foot of the Pyrenées, only Quail, Partridge, and Hare-shooting can be depended upon.

From Pau excursions for shooting and fishing are made to the Pyrenées. The chief attraction is the Isard, or Chamois. There are also Bears, Lynxes, and smaller game, that *may* be met with when Isard-shooting, but are not in sufficient numbers to warrant an excursion being made in pursuit of them alone.

To shoot the Isard, go to Pau by rail; leave in a *well-horsed* carriage for Eaux Chaudes; bait at Louvie. Guides may be obtained at Eaux Chaudes, but better at Eaux Bonnes, higher up the mountain. If the



Quail (*Coturnix Major*). Sandgrouse you silly!

sportsman is a good mountaineer, he may attempt stalking; if not, beaters must be employed and a battue organised. The expense is not great, if borne by two or three sportsmen; but one can hardly shoot all the game he might have a chance at, and when there is but one gun the beaters often drive the Isard through a wrong pass, and thus all the expense and trouble is for nothing; with two or three guns this is next to impossible. If, therefore, a party is made up, by all means arrange a drive; if only one, stalking is likely to prove every bit as successful. If stalking is decided upon, see that the guide is *not* provided with a horse; he may want it, but it is always in the way, and an obstacle not easily got over when hard climbing has to be done. Set the example by going on foot yourself, and insist upon no horse being taken. In August a camping-out party in the Pyrenées may expect fair sport and good weather.

At Biarritz the shooting is at shore-birds; a few Snipe and Partridges and Quail in season.

Near La Feste the wild-fowl shooting is excellent, especially in the Bassin d'Arcachon and L'Etaing de Parentis. The same shooting is also excellent throughout Gironde and Charente Inférieure, and also in Calvados, Normandy.

GERMANY.

Throughout Germany, the forests and hunting-grounds are in the hands of noblemen or private proprietors. Most of the latter farm the game for sale; the former strictly preserve. The sportsman will therefore see that unless he has a recommendation or introduction to some proprietor, the sport he will obtain is likely to prove *nil.*

In the Royal forests, and they are very numerous, drives are regularly organised; and if the sportsman is fortunate enough to get an invitation to one of these battues, he will in all probability be satiated with slaughter, the number of animals or birds killed being almost incredible. The head-keeper usually posts the sportsmen, and by various stratagems contrives to score the most game to the highest-titled personage engaging in the sport. In fact, the records published of several Royal battues are highly amusing to the real sportsman: every sportsman killing according to his social rank; and where there is a drop from a Prince to a Count, there is a corresponding drop in the killed game scored to each. That

The Emperor of Germany at a Deer Drive, 1882.

Royalty should receive the best posts in a deer or other drive, one of course expects; but that they should invariably slaughter the most and finest game, and that the gradations should be so perfect, betokens great tact on the part of the head-keeper.

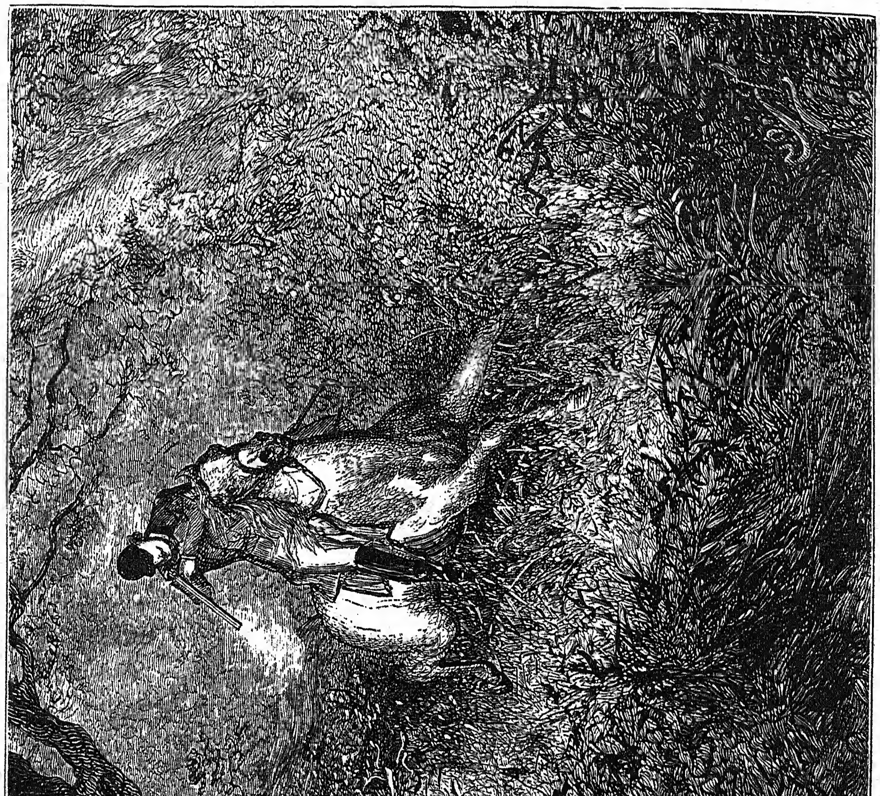
So much for the sport as enjoyed by many of the German nobility —*chacun à son goût*—and doubtless an Englishman would soon tire of such pre-arranged sport. He should therefore get a *carte blanche* from some nobleman or proprietor to stalk game on his preserves, and then, by making friends with the forester, fair legitimate sport may be obtained; but we doubt if it would be so enjoyable as that given by some small landed proprietor who does not farm altogether for the market.

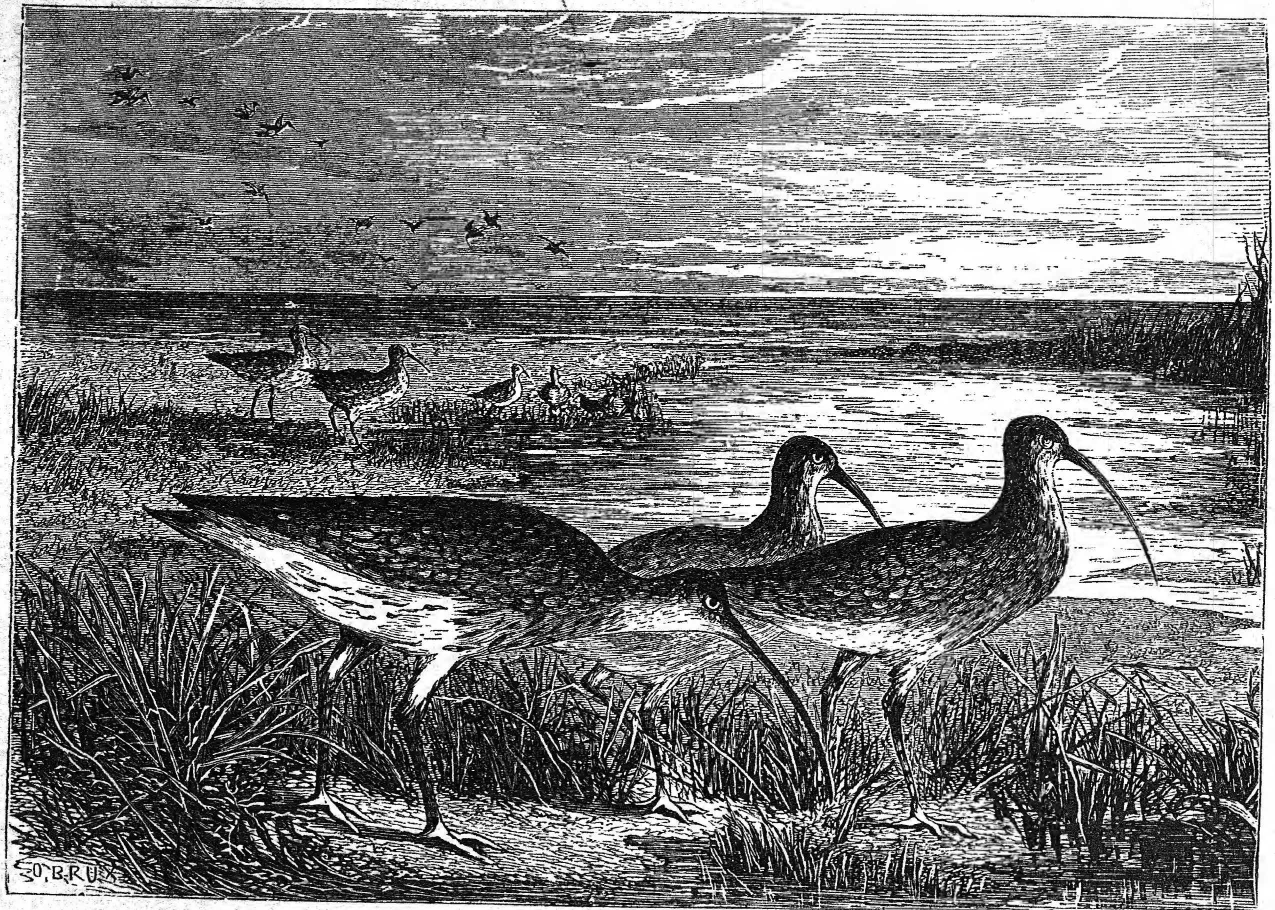
Near Hamburg there are several game farmers or lessees who shoot for the German and London markets. Large herds of Fallow Deer (*Cervus dama*) are here to be met with.

Roe-deer are fairly plentiful throughout Germany, and are more often treated as vermin than game. In Westphalia it was the custom for the farmers to assemble every three or four years and have a grand deer drive; but now *nous avons changé tout ça*, and "still-hunting," or stalking, and Royal battues are all that is left; game is, however, very plentiful, especially in Southern Westphalia. In Bavaria game is also plentiful; very fair Chamois-hunting in the highlands, especially in the Partenkïrchen region.

Hares, Capercailzie, Blackcock, Grouse, Partridges, Snipe, Woodcock, are very plentiful in some districts. In Saxony and Silesia Hares are especially numerous.

Boar-hunting is a favourite sport throughout the German Empire, and is practised in several ways: hunting with hounds and spearing, ditto in covert, and shooting when brought to bay; lying *caché* on a moonlight night in a run and awaiting the animals' visit to the feeding-ground; and shooting from horseback, as illustrated. Of these, the first is perhaps the most exciting, the battue most prolific in slaughter, the lying-in-wait business the most tedious. The most sportsmanlike is to work the cover with a dozen hounds, follow the beast till brought to bay, and bag him in the most convenient manner. At times, however, the dogs are not forthcoming, or there are not sufficient to make the sport successful; the hunter may then mount, ride through the forest,





The Curlew (*Numenius arquata*).

try a few of the coverts, and take his chance of finding and shooting a boar.

The Emperor William is still an enthusiastic shot, though in his 87th year. In a two days' shoot this November, on Count Stolberg's estates, he bagged 78 hares, 21 boars, and 5 deer. The Crown Prince is also a clever, enduring, and persevering sportsman. There is every probability that game, both large and small, will be plentiful in Germany for many years.

HOLLAND.

This country, the home of the Hare, Curlew and Wild-fowl, offers little attraction to the sportsman, although the wild-fowl shooting is good.

The Curlew (*Numenius arquata*) as well as many other wild-fowl, breed in Holland in large quantities.

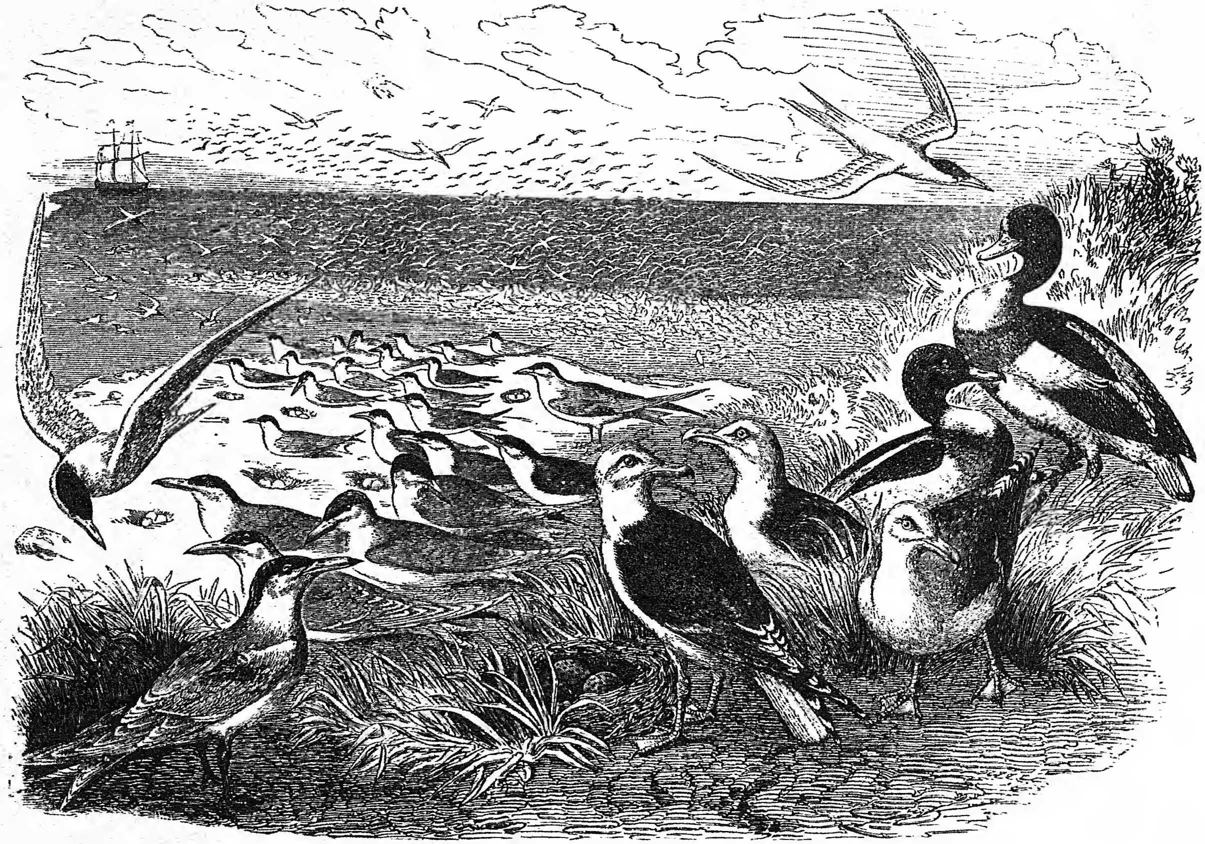
There are certain restrictions imposed by local authorities on shore-shooting in Holland, applying in most cases to the season and the size of the gun.

It is usual to charter a sailing skiff, and armed with a big shoulder-gun and a "cripple-stopper," to sail down the many "haafs." The Brille is a very good one, taking the sandbanks below Rotterdam, and working down the coast towards Helvoetslius; or from Amsterdam northwards, taking the Zuider Zee, De Wadden. In fact there is good wild-fowling all along the German coast, and amongst the Frisian islands.

Inland the shooting is poor. Hares are plentiful, and there are Partridges, Woodcock and Quail in the eastern provinces.

ITALY.

Italy affords abundant sport to both wing and rifle shots The Italian nobles and landowners are exceedingly obliging and courteous, and render every facility to English or American gentlemen desirous of partaking in the sports of their country. A permit to carry a gun is necessary, and although the formalities for procuring it are irksome, it is very seldom refused to foreigners if they have a passport and recommendation from an embassy or consulate. To procure this permit a demand accompanied by the recommendation, and documents proving the age and identity, must be presented to the mayor (*Municipio Sindaco*); a certificate (*attestate di*



Wild-fowl on the Dutch coast.

(2 ducks [illegible]

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notovieta) will then be given to him; another document called *Nulla osta* must be applied for at the police office, declaring that there is no objection to be offered to his shooting; furnished with these documents, he requests from the political authorities (*Questura*) a license to shoot, and pays 25 lira for the same. This license lasts one year only from the day on which it is issued, and is applicable alike to all parts of Italy and Sicily, except in a few reserved localities. According to the present Italian law, game is declared to belong to the one who kills or takes it. Landowners, however, have the right to forbid shooting on their ground, in which case a notice board is put up with the inscription, *Caccia proibita*, and in this case permission must be asked to shoot on that ground; on other lands it is free, and permission is readily granted in reserved places, especially to foreigners and for a time.

For shooting deer, wild goats, chamois, wild boars, or pheasants, a special license must be obtained, in which the kind of game is mentioned. The Italian authorities, however, are considering the game law question, and it is possible that more stringent and uniform conditions, especially relating to the close time for game, will be made. At present, the breeding season varies in the different provinces, but from the 1st of March to the middle of August may be considered as the close time for game in Italy.

The sportsman visiting Italy for large game shooting will find a double rifle of 450-bore the most useful weapon. For the wild goat stalking in the Alps a long range single rifle may be of more service, whilst a ·577 Express is the most effectual weapon for stopping a wild boar.

Whilst hunting wild boars, the Italians are invariably armed with long knives about 15 inches in the blade, and of great strength, but probably few Englishmen would be at home in handling such a weapon. A cartridge-belt is very essential, as the hunter of the wild goat will have to shoot and load in most peculiar and dangerous positions.

For ordinary shooting a double 12-bore choke is the best weapon, with a good supply of cartridges loaded with No. 7 shot for quail and snipe, and No. 5 for the larger birds. For duck-shooting a double 8-bore will be found sufficiently large. Powder should be taken from England, but chilled shot and Eley's wadding and cases may be obtained in most of the large towns, although much dearer than at home.

These remarks also apply to Sicily, Sardinia, Corsica, and the small adjacent islands.

In Italy the only deer are preserved upon Royal estates, and in the parks of noblemen.

The Wild Goat (*Capra ibex*) may be found upon the summits of the Alps. Aosta is the most convenient centre, and in the Gran Savadiso in the range of Monte Rosa, at a height of 8,000 or 10,000 feet, the greatest number are met with. These animals, since the death of Victor Emmanuel have become very rare, and bid soon to entirely disappear. They are about the size of the common goat, with dark stripes upon the sides, long blackish horns, brilliant eyes, mobile ears, and black beard. Their haunts lie on peaks bordering upon the eternal snows, and they feed upon the scanty herbage, and buds of the Alpine willow. The hunting of these animals is a dangerous undertaking, requiring great endurance and good nerve, the mountains being covered with snow, and surrounded by precipices, whilst strong whirlwinds are frequent in the mountain gorges. In fact, none without an excellent nerve and steady hand can hope to kill the wild goat at the dizzy height, and amidst the dangerous surroundings which are necessary to its existence. When hard pressed the wild goat has been known to turn and charge the hunter.

The Chamois (*Antelope rupicapra tragus*) may be obtained from either of the following centres:—in the Valteline, *Bormio;* in Valsesia, *Vavalla;* in Ossola, *Domodossola;* in Aosta, *Aosta*. The pursuit is very dangerous, and guides are indispensable; good and experienced men may be found at any of the above-mentioned towns. The chamois is but rarely surprised. A long-range rifle is essential. On seeing or scenting the hunter it immediately takes to flight, and its organs of sight, hearing and smell, are most perfect.

It is gregarious in its habits, living in the lower heights of the Alps, but never descending to the plains. It is small in size: both males and females have horns, black, smooth, and hooked. Its hair is coarse and thick, and dark-brown or chestnut in summer, lighter or fawn colour in winter. The forehead, muzzle, and sides of lower jaw are white. It is exceedingly agile and sure-footed, and often the arduous chase will prove unproductive. For further information respecting chamois-hunting we refer the reader to the notes on the "Tyrol."

The Wild Boar (*Sus scrofa*) may be found in considerable quantities in

Southern Italy. The landowners there are not so ready to give permission to shoot, but it is by no means impossible to obtain it. In the province of Grosseto, centre *Roca strada*. In Naples, lodge at *Eboli;* in the adjoining woods of Policono and Persano many wild boars may be met with, and hunted by lying in ambush at nights, or with dogs. Damp, dark localities in the forests are chosen for its lairs, and its food consists of larvæ, grubs of cockchafers, reptiles, birds' eggs, field-mice, moles, and all young animals. It is very destructive, and, when wounded, ferocious; and wounds from its tusks are very difficult to heal. In charging it may be shot, or met by the long, heavy boar-knife. The length of the wild boar varies considerably, but it has been known to attain a length of 4 feet 6 inches from the end of the muzzle to the beginning of the tail. Its whole body is covered with stiff, hard bristles of a blackish-brown colour, and longer on the back and round the ears. The long bristles stand erect when the animal is excited, which, together with his enormous tusks, give him a very formidable appearance. The body is large and thick-set: the ears (the weakest part) short, straight, and mobile. *Battues* are occasionally organised at the above-named places for destroying the boars, and any English gentleman would be welcomed upon those occasions.

For the shot-gun plenty of practice may be obtained throughout Italy: the largest shooting comprises ducks and other aquatic birds. The best localities for this shooting are in the Venetian valleys and lagoons. The sportsmen sit in tubs (*capanelle*) at the openings of the valleys, and fire at the flocks of ducks, which they keep sending back to each other. For this shooting the sportsman should select one of the following centres: *Bologna*, *Comacchiò*, *Padua* or *Venezia*. At either of these places good sport may be obtained, and several Italian counts, themselves infatuated with this sport, will assist visitors in every possible way.

Quails (*Capercailzie*) visit Italy in enormous quantities about the end of summer, when they are ruthlessly shot, netted, or knocked over with sticks by the excited populace. A little later, good shooting may be had along the coast from Civita Vecchia to Cape Spartavento, a favourite locality being the Island of Capri. Quail are also to be found on most of the Italian plains. On the lower slopes of the Alps, the Blackcock (*Tetrao tetrix*) and White Partridge (*Lagopus albus*) may be found in considerable

Duck Shooting from Capanelle in the Venetian Lagoon.

quantities: the former, however, are far more numerous than the latter. The red-legged partridge and hares are also to be found generally throughout Italy and Sicily.

In the marshes, but especially in the Neapolitan territory, snipe and woodcock abound; aquatic birds of various descriptions are met with in good quantities in almost all the lakes and valleys. In the island of Sicily rabbits are also found, but there are none in Italy.

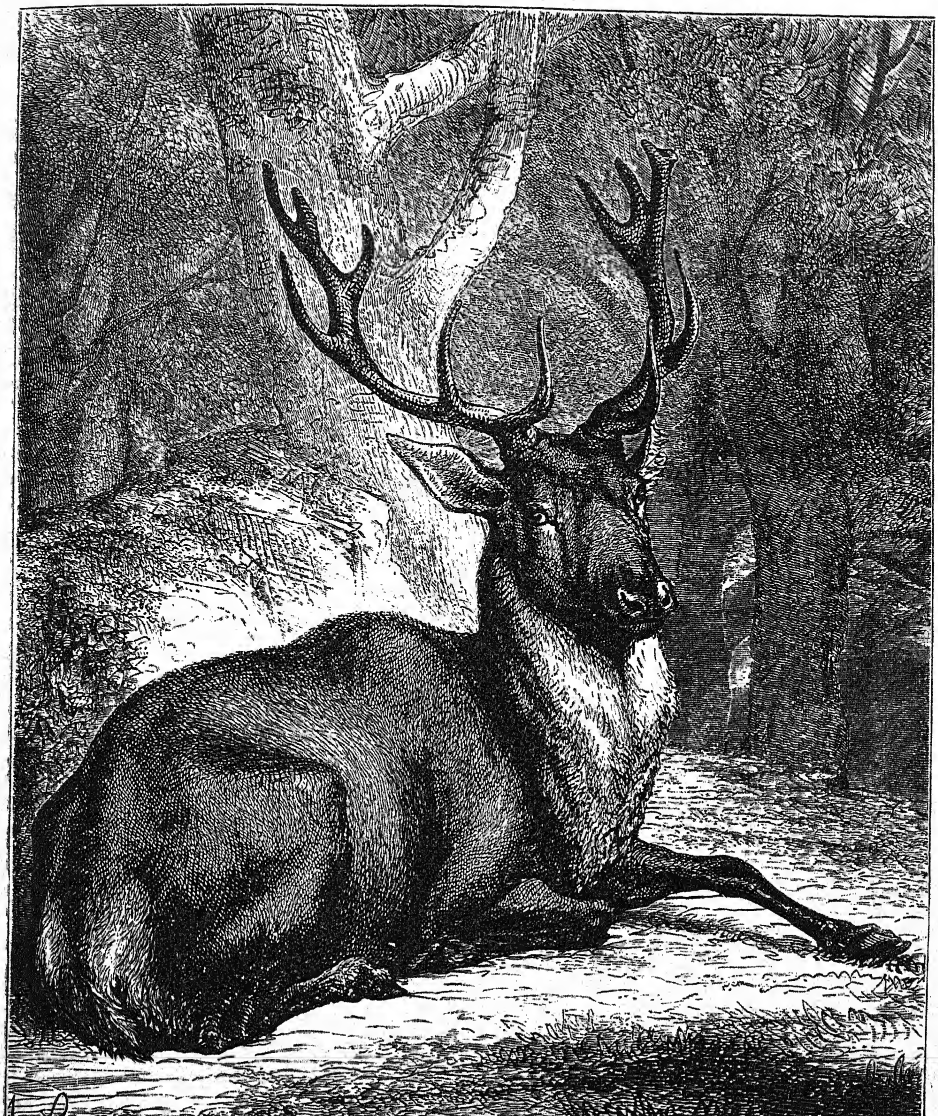
SARDINIA.

For the island of Sardinia the same permit is requisite as for Italy, and the same general remarks are applicable. The shooting season, however, extends from the 1st of August to the 31st of March. The island abounds with game. Wild boars, red and fallow deer, are sufficiently numerous as to afford good and constant sport. There is here also the Moufloni (*Caprovis musimon*) or wild sheep. These animals live in droves upon the hills and slopes; they are about the size of the ordinary English sheep, but more stoutly made; the fleece is woolly, of a greyish colour, and covered with long silky hair; the horns are large, triangular at the base and flattened towards the extremities; in the female the horns are wanting. There are two very good centres from which the surrounding country may be easily worked: Castiados, reached from the Port of Cagliari, or Ozieri from Porto Torres.

Good mixed shooting for the shot-gun is also plentiful in Sardinia, and at the present time it is not particularly overrun with sportsman.

CORSICA.

The island of Corsica has been of late rather overrun with sportsmen. For the rifle, red deer may be obtained in autumn, and a few Moufloni or wild sheep (see *Sardinia*). For the shot-gun there is excellent quail shooting in March, and partridges in autumn. Ducks and other aquatic birds are also to be met with in fair quantities.



The Red-Deer *(Cervus Elaphus)*.

MADEIRA.

There is very little shooting to be obtained in this island: visitors however, may find a few red-legged Partridges in the mountains, and some rock Pigeons on the sea cliffs.

There are three respectable English hotels upon the island.

PORTUGAL.

The game of Portugal consists of Red and Fallow Deer, Hares, Quail, Partridges, Woodcock and Snipe.

Very good sport is to be had in the Sierras de Monchique in *Algarve*, on the Sierra d'Estrellas, and in the provinces of Minho and *Trazos Montes*. The sport near Montalegre, *Chaves* and Mirandella in the latter province has been recommended.

Gunpowder or cartridges should be taken. The first is subject to a duty of 200 reis, and the latter 300 reis per kilogramme. Guns pay 30 per cent. *ad valorem*, but one is passed if the passport has the consul's vise. Shot pays 30 reis per kilogramme only; therefore take powder and shot, and load your cartridges in Portugal. The ammunition sold in Portugal is mostly of French and Belgian manufacture, and worthless. We have been unable to ascertain the cost of a license, but one is required.

In the Azores there is little shooting, and consists wholly of Quails and Rabbits, a few Partridges and Pigeons, and a fair assortment of Sea-fowl.

RUSSIA.

This country has a greater variety of game than any other in Europe. In the forest of Bialowicza, in Lithuania, the Auroch *(Bison priscus)* is carefully preserved for the private sport of the Czar and the Imperial family. It is also to be found sparsely scattered over the Caucasian provinces. In the extreme north the Polar Bear, the Seal, Walrus, Musk-ox *(Bos Moschatus)*. In the more temperate regions and the south, are Brown Bears, Wolves, Otters, Lynxes, Sables, Deer, Grouse, Partridges, Snipe, &c., &c.

In no country does the Red Deer *(Cervus elaphus)* attain greater perfection than in Central and Western Russia.

For Ducks and Wild-fowl the islands at the mouth of the Neva afford good ground, and large bags can be made there in the spring.

A trip to Kajana, in Finland, will give an opportunity of some of the finest Wild-fowl shooting in the world; there is also fair sport on the eastern side of Lake Ladoga, and good chances at large game between that lake and Lake Onega.

Hares are exceedingly plentiful throughout the empire, and battues are frequently organised; but a walk through any of the fields will generally flush them in fair numbers.

The islands in the Gulf of Bothnia, all along the coast of Finland, are well-stocked with the Great Seal and other animals. If the sportsman cares to rough it, he can get good sport at these animals by going to Umea, in Sweden, and then crossing over to Wasa, and chartering a sailing-boat, cruise among the islands. In winter they are plentiful in the Gulf of Finland, but in summer they are not plentiful south of Wasa. The skins are comparatively worthless, and may be bought for about 3 roubles each.

In the Crimea, Deer can be had in the forests of the Tchadyr-dagh. These are Crown preserves, but it is possible to get permission from July 12th to end of season. The application must go through the English consul at Sebastopol, to the Governor of Simpheropol. Yalta is the most comfortable head-quarters in Tchadyr-dagh. Partridges, Quail and Woodcock are also fairly plentiful in the Crimea.

In the Caucasus are the European Pheasant and Partridge, the Francolin Partridge, Blackcock, large Sand-grouse, the Great and Lesser Bustard, Woodcock, Snipe, Double Snipe, Plovers, Curlew, and all sorts of wild-fowl.

As a rule, however, game will not be found in any great quantity within twenty miles of any town of moderate size.

November is perhaps the best time for sport at feathered game, and in October trips may be made into the Caucasian mountains after Bears, Oorial or Mountain Sheep, Ibex, and Chamois. On the plateaux—Wild Pigs, Roe and other Deer.

Camping-out is necessary to obtain good sport, and is difficult and expensive work. If it is the intention of the sportsman to attempt a trip into the Caucasian range, he should take camping outfit from England, and common revolvers, pistols and knives for the Tartar chiefs who will not take money.

Sport and travel in the Caucasus is, however, risky, and the sportsman may do better by keeping to the "Steppes" or plains. Here he may stalk Antelope or "Giran," and the Persian Antelope. Hares and Snipe in abundance; Quail and Water-fowl plentiful at certain seasons; coursing may be practised on the Steppes.

In Central Russia good bird-shooting—as Rebhühn, Snipe, Sand-grouse, Bustards—may be frequently had near the towns and villages, and the shooting, though nominally free, is in the possession of the peasants, who are more or less easily appeased. No rule can be laid down as to the more likely localities for birds, since ground that for weeks is swarmed with Snipe, Quail, or Sand-grouse, may the next present none, Herons or a few Bustards taking their place. Nevertheless, there are very few places throughout the empire where shooting of some kind cannot be obtained. Even near large towns as Moscow and Oranienburg, the Rebhühn exists in plenty.

Wolf and Bear shooting is obtainable in winter, and Wolf-killing parties are always made welcome in the villages and scattered towns.

In Asian Russia game is abundant, but the grounds are difficult of access. A traveller through Central or Eastern Russia may take his shot-gun, and depend upon having good use for it. But the country cannot be recommended at present as one to go to for sport, as others equally as good are more readily accessible.

Deer are not so plentiful in Russia as one might expect, large numbers falling a yearly prey to the wolves.

FINLAND

has a more advanced sporting community than Russia Proper. Shooting generally is to be had for the asking. The close seasons are November 15th to August 31st for Partridges; March 15th to June 1st for Eider-duck; March 15th to July 14th for Snipe, the *Anatidæ*, Woodcock, Wild Geese, and Swans; and March 15th to August 9th for other game not specified, save Morse and Beaver, the killing of which is at present prohibited. Wolves, Bears, Lynxes, Wolverines, Foxes, Otters, Seals, may be killed by any one wherever seen. There is good Reindeer shooting in the *Eastern* and North-Eastern districts. Capercailzie, Blackcock, Ptarmigan, Willow-grouse,

Hazel-hen, Hares, and Wild-fowl exist in plenty, and afford good sport. There is excellent fishing in Finland, nearly all of which is free.

Perhaps no place in the world is more prolific in Water-fowl and Snipe than the Valley of the Volga. All members of the Scolopax family are to be found; but the Common Snipe is the more plentiful, whilst the Double Snipe is not unfrequently met with.

Guns and ammunition must be taken from England; the passport must receive the *visé* of the Russian Consul, and the duty of guns is about 18s. each. Native powder is difficult to obtain, and is vile rubbish.

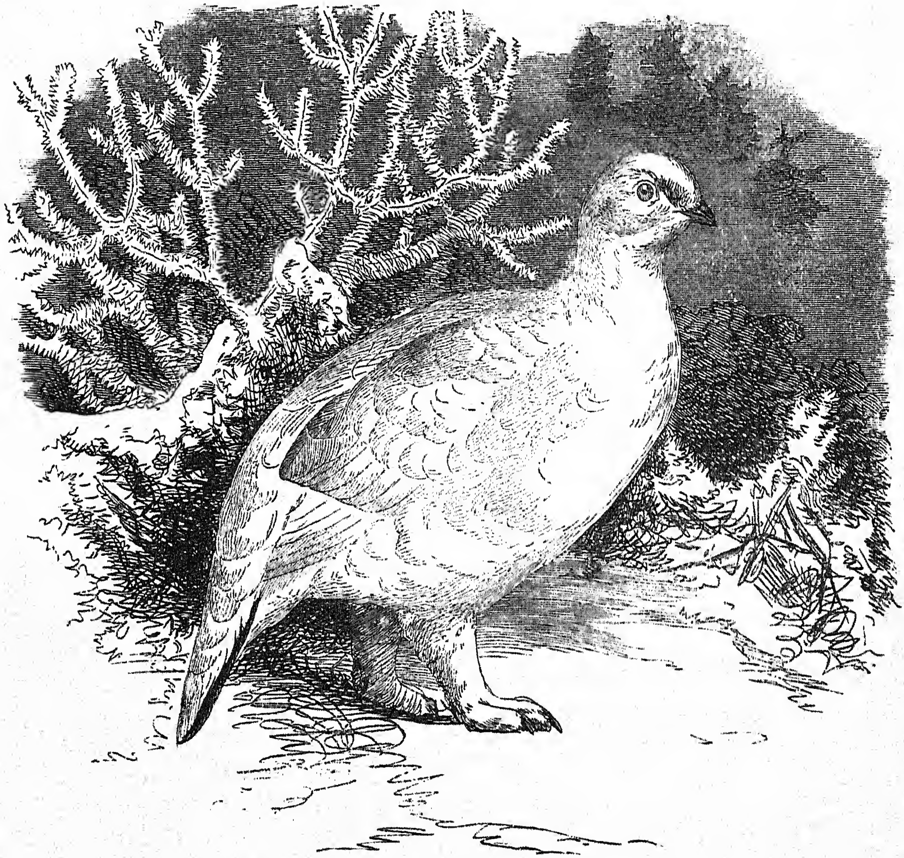
SCANDINAVIA.

Norway for some years has been the favourite summer resort of many English sportsmen, especially those who have also a passion for fly-fishing. As a country solely for shooting, Scandinavia cannot be recommended; game in nearly all accessible districts is scarce, and the restrictions now placed upon English sportsmen and the difficulties of travel, makes the game scarcely worth the candle.

To those, however, who wish to combine fishing and shooting with a pleasant tour, no country so close home offers so many inducements as Scandinavia. The best way is to leave by steamer from London or Hull to Christiana. The more ardent sportsmen then post to the fjeld they intend to shoot over, and content themselves with a shakedown for a bed, and the coarse fare of barley cakes and rye bread a mountain söter affords. A more comfortable way is to hire a carriole at Christiana for the whole time of the visit, and make use of the station ponies. This saves much trouble in changing luggage, &c., from carriole to carriole every ten miles or so. The cost of a game license for Norway is now about £11 10s., and gives the right to shoot on public lands. No license is required to kill game on private preserves, so that arrangements are often made with landowners to have the sole privilege of shooting over the said land with dogs. This answers fairly well with Grouse-shootings, the best of which include Ödmark or unfenced pasture-land. The system of netting and snaring game by the tenants, however, makes the shootings of but little value, compared with those of British moors.

The game now to be met with in Scandinavia includes Elk (*Cervus*

alces) or "Elg," now very scarce except in private forests; the Wärmland, Jemtland, Westerbotten and Trondhjem districts are perhaps the best stocked. From 800 to 1,000 are shot annually in the Midland districts



Alpine Ptarmigan (*Lagopus albus*).

alone. Open season—only one month, September. Red-deer or "Hjort," Roebucks or "Raget," are found in the Dovre fjeld and the valleys of the Hardanger and Kjolen mountains.

The following animals the sportsman is not likely to meet with, unless

he travels to the confines of Lapland or winters in Scandinavia:—Bear or "Björn, Glutton or "Filfras," Lynx or Lo, Reindeer or "Ren." Of smaller animals there are Wolves (*Väig*), Badgers (*Gräfsvin*), Otters, Foxes and Lemmings.

Of feathered game, the Ripa or Ptarmigan is perhaps the most sought after. It will be found near the summits of the Dovre, Hardanger, and other mountains, and once found is easily shot. Dogs are of use, but it gives bad scent; a good eye is of much assistance.

The Capercailzie or "Tjäder" is also found on the slopes of most of the mountain ranges of Norway and Sweden, and is again plentiful.

The Capercailzie may be shot with either a ·360 or ·380 rifle, or a Choke-bore gun, with No. 3 or 1 shot. In the autumn the most successful way is to call them and shoot them from ambush, or mark them down at their roosting-place, and visit the place after dark and shoot the whole brood, commencing of course with those on the lower branches. In its flight the Capercailzie is a slow, cumbersome bird, and easily brought to bag.

Black Cock or "Orre" are very plentiful, and may be brought to bag with ordinary guns and No. 4 shot.

Partridges or "Rapphöna" are plentiful in Southern Sweden, and not uncommon in the North. They may be found in quantities in Jemtland and Dalecarlia, but in Scaim, Halland, and the island of Öland 10 to 20 brace per day may easily be bagged.

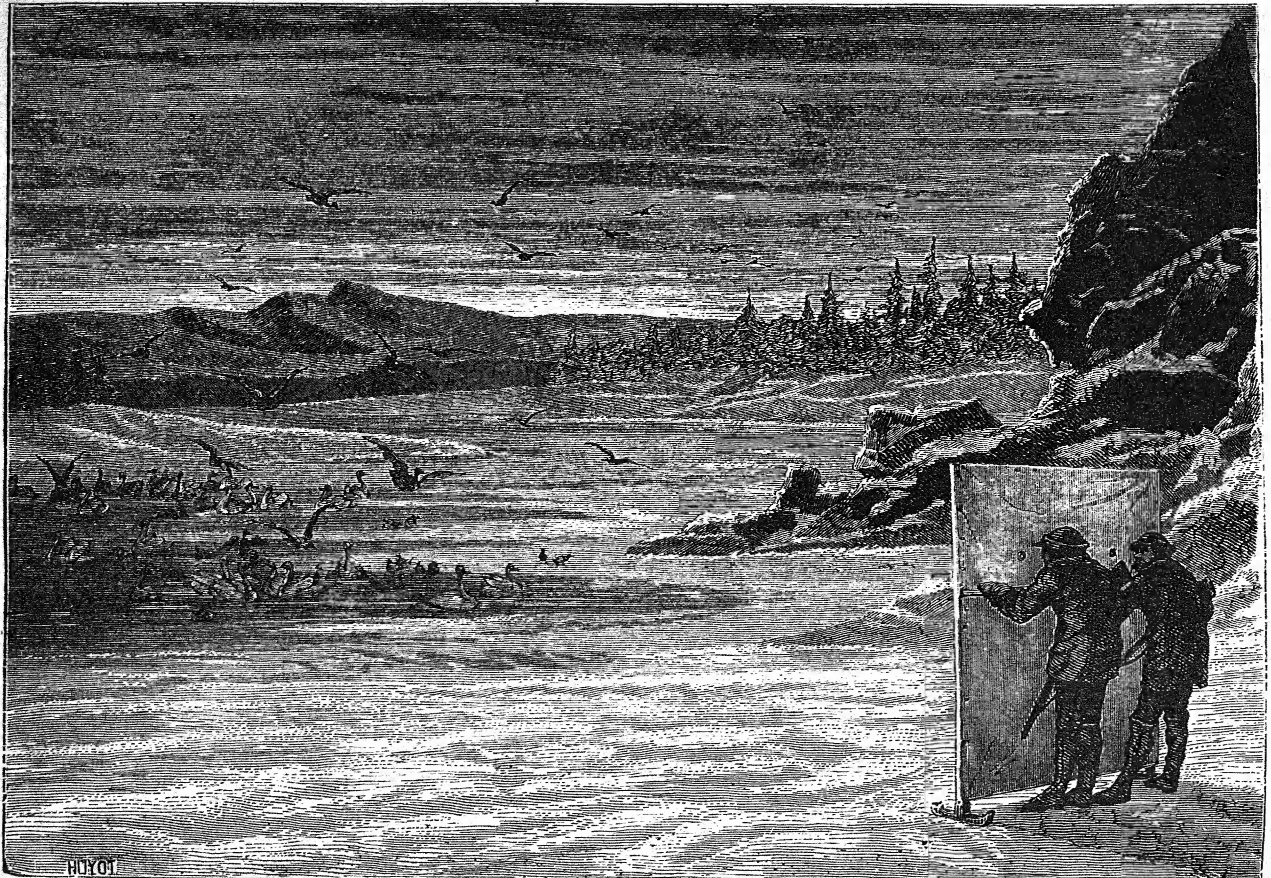
The Hazel-hen or "Jerpe," called also Gellinotte des Bois (*Tetrao bonasia*), is fairly plentiful in the northern and midland districts.

The Woodcock or "Morkölla," and the Snipe or "Bekasin" are to be found throughout Sweden and Norway, south of 65° N. latitude.

Of Wild-fowl there are many kinds—Swans, Geese, Ducks, Teal, Whimbrel, Curlew, Widgeon, Sea-fowl, &c. Most of the fjords on the western coast of Norway abound with these wild-fowl. Ducks, &c., are plentiful in the fjords up the Baltic.

In winter Wild-fowl, especially Swans, may be shot by use of a canvas screen upon runners. The screen must be white, and have two or more peep-holes large enough to thrust the barrel of the gun through when shooting.

Hares, scarce, except in Scaim, Smaland, and Westerbotten. Plover



Shooting Wild-fowl in Winter from a Screen.

and Broch are common, and the shooting in Sweden generally good and plentiful.

For general sport, fishing, and shooting, the districts of Jemtland and Wärmland in Sweden, and the Buckerud and Trondhjem districts in Norway have been recommended. The best season is from the end of July to October.

SPAIN.

Owing to the few people who take out gun licenses in Spain, game is plentiful; and as the country is full of interest, and within easy reach of England, sportsmen may go farther afield and fare worse.

If Isard, Bear, Boar or Deer shooting is contemplated, a ·450 double Express rifle should be taken, with cartridges. If only small game is expected, a double 12-bore will be sufficient. Cartridges or cartridge-cases should be taken, for although they, as well as 16- and 20-bores, may be obtained at the chief Spanish towns, they are of French manufacture, of bad quality, and dear. A hammerless gun, 16- or 20-bore, with an extra pair of ·450-bore rifle barrels, are the most convenient for general shooting in the Pyrenées, especially if camping-out is contemplated. A permit for carrying arms must be obtained from the Spanish Consulate in London, and costs, with Consul's charges, about £1; duty amounting to eight or ten shillings, according to weight, will have to be paid to the Customs officers. Gunpowder should be taken, or cartridges; see Table at close of "Shooting Notes" for duty. A revolver will also be an advantage especially if Andalusia or Biscayo are visited. A hunting-knife will be found useful, and should be taken. Other things, and most camp *requisites*, may be obtained in Spain.

The districts most visited and readily accessible for sporting purposes are Voscongadas, Gallicia and Andalusia. The first is reached by steamer to San Sebastian, or overland through France; the second by steamer from Liverpool or Bordeaux to Vigo or Coruña; the last by steamer to Cadiz, Gibraltar or Malaga.

It must not be supposed, however, that these are the only provinces in which game is found: sport is to be had throughout Spain and Portugal; but game is less plentiful near the Bilbao Mines and similar commercial

districts. The gun license gives the bearer permission to shoot throughout the whole of Spain, except upon preserved land, which is not at all general, preserving being only practised to any extent in the south.

Autumn is the best time for sport generally; and if the sportsman leaves England at the commencement of August, he will reach the ground at a time when Deer are in their prime and Quail plentiful. The game of Spain may be said to consist of Isard or Chamois, Lynxes—only found in the Pyrenées and the more lofty Sierras—Red, Fallow, and Roe Deer, Boars, Wolves, Bears, Hares, Quail, Partridges, Woodcock, Snipe, Ducks, &c.

In the south it is best to get permission to shoot over a preserve, or "Coto," on which there are frequent battues of both Deer and Boar, or the sportsman may stalk or shoot over the Crown lands if he prefers it—the latter not a very successful method.

In Gallicia and the more remote districts of northern Spain, the best way is to get a guide—costing from 1s. 8d. per diem—and shoot over dogs, or beat the forests. Dogs in Gallicia are badly broken, as a rule: the sportsman would do well to take his own dogs—duty, 2s. per head. To work the forests large dogs are required, and the generality of sportsmen must depend upon the local supply, or ride through the forest and take their chance of stray shots.

Within twenty miles of Orense is very good shooting, in the neighbourhood of Ginzo and Verin; also near Rubian, about twenty-five miles north-east of Orense.

Farther north the game is chiefly Hares and Partridges, and Ducks and Wild-fowl are very numerous. A lake called Laguna Antela, close to Ginzo, is a famous resort for Wild-fowl.

The best time for a visit to San Sebastian is in August or September. Quail are then plentiful, and the *élite* of Spanish society are to be found at this fashionable watering-place. In the neighbourhood are Hares, Partridges, Woodcocks, Snipe and Water-fowl; Quail, however, can always be depended upon at this time, whilst other birds are some seasons scarce.

The Pyrenées offer to the sportsman two kinds of sport, which—if a fair mountaineer—he should avail himself of: they are Bear and Isard shooting. These excursions, however, are usually made from Pau on

the French side, and for convenience we have included them in the "Notes on France."

Bears are also numerous in the Cantabrian Mountains. To get there, go by rail to Torrelavega in Santander, thence by coach to Unquera, next day by coach to Urdon and walk to Potes, the sporting centre for the famous game region of Picos de Europa. The usual plan is to engage some twenty beaters, who surround overnight an area enclosing one or more Bears; and in the morning diminish the circle, leaving one place from which the Bears make their exit, and at which the guns are posted. In the Cantabrians are also to be had Chamois, a few Boar, Hares, Eagles, Vultures, Partridges and Woodcock. Camping-out, although not absolutely necessary, is often the most comfortable, the posadas offering very poor accommodation. Those who intend camping-out in Spain cannot do better than provide themselves with a small tent, a bag-bed, or a "manta," and sleep upon the ground; and all travellers in Spain out of the beaten track of tourists must be prepared to rough it, and put up with bad cooking and many lesser evils.

SWITZERLAND.

For Chamois-hunting in Switzerland, the Bernese Oberland is again open to sportsmen. The season varies, but as a rule it commences on September 1st throughout Switzerland, but in the Bernese Oberland on October 1st. A *permit de chasse*, costing 100 francs, is necessary. For Chamois the Engadine is perhaps the best district, but Pontresina must be avoided. Zemetz has also been recommended, and there is very fair shooting in the Rheinwald.

The other game consists of an occasional Bear or Fox, Partridges, Grouse and Woodcock, with Quail in some of the valleys, but not very plentiful.

By a recent regulation, a person must be a resident in the Republic before a *permit* will be granted.

TURKEY AND ROUMANIA, AND THE GRECIAN ARCHIPELAGO.

During the present unsettled state of affairs in this part of the world, game laws are not enforced, if any exist, and the shooting, which is very rough, is free to all.

North of the Balkans, including the various dependencies of Servia, Bulgaria, Wallachia and Moldavia, the watershed of the lower Danube abounds with both large and small game; it is, however, now decreasing rapidly, owing to the peasants killing the game at all seasons; poachers and pot-hunters are encouraged, that they may keep the tables of their friends in office well supplied with game. In the Carpathian Mountains and the wooded slopes and spurs of the Balkans, the Roe-deer (*Cervus capreolus*) may be met with; towards the summits the Chamois and the Wild Goat ("Steinboch") are numerous. In the forest slopes or on the wooded plains, the wild boar and small brown bear are to be had. Wolves and foxes abound in the Carpathians, and excursions for shooting any of the above animals may be made with advantage from either Ibraila or Bucharest.

Birds and small game are plentiful. The bustard is frequently met with, but must be shot with a small rifle—·360 is the best—as they are too wild to be obtained with a shot gun.

Vast myriads of snipe and water-fowl of all kinds inhabit the marshes all along the vastly extensive inundated banks of the Danube and its tributaries.

Quail on passage are generally plentiful, and the blackcock and hazel-hen are pretty general.

In the spring and autumn there is usually a good sprinkling of wood-cock; the autumn passage generally commences the last week in October, and some years is exceptionally plentiful.

There are no rabbits, and hares and partridges are scarce, being killed at all seasons by the peasants.

These remarks also apply to Southern Turkey and Greece, which possess besides considerable additions, both in small mammalia and aves.

Both the Roe-deer and the small brown Bear may be met with in the Morea, and on the plains of Roumelia, Bulgaria, and Albania. Small game is very plentiful. Eastern Roumelia especially is well stocked, and on the plains between Adrianople and Philippopolis, in the valley of the Maritza, pheasants are as common as beefsteaks.

On the Albanian coast, and mostly throughout the Grecian Archipelago, flamingoes, white and Dalmatian pelicans, cormorants, blue-winged and the

little white-fronted geese are plentiful; whilst on the Ionian Islands the rare marbled duck is occasionally met with.

In all the valleys and swamps snipe, herons, bittern, and other waders are exceedingly plentiful; whilst near the coast there may be had, in addition, black-headed and other rare and common gulls and wild fowl.

The Francolin (*Tetrao francolinus*) may be had in small quantities throughout the Archipelago and Turkey, also a few red partridges; the partridges, however, are rapidly diminishing in quantity throughout Greece and Turkey.

We consider Turkey, Greece, and the adjacent islands fit to be ranked amongst the finest hunting-grounds of Europe. Game is plentiful in most localities, and in the valleys the wild fowl are innumerable.

To yachtsmen these countries offer great facilities, and a cruise amongst the Ionian Islands and along the coasts of Dalmatia, Albania and Acarnania ought to amply repay the sportsman, without necessitating any long inland excursions.

The weapons chosen for general shooting in these countries is the double 12-bore shot gun for deer and bear shooting in the Balkans, Carpathians and in Morea, a ·450 rifle and shot-gun, chambered for the No. 1 Express, and the 12 or 16-gauge paper-case is preferred.

If exclusively for wild-fowl shooting, a double 10-bore will be found none too large.

Both in Turkey and Greece good powder is difficult to obtain, and very dear.

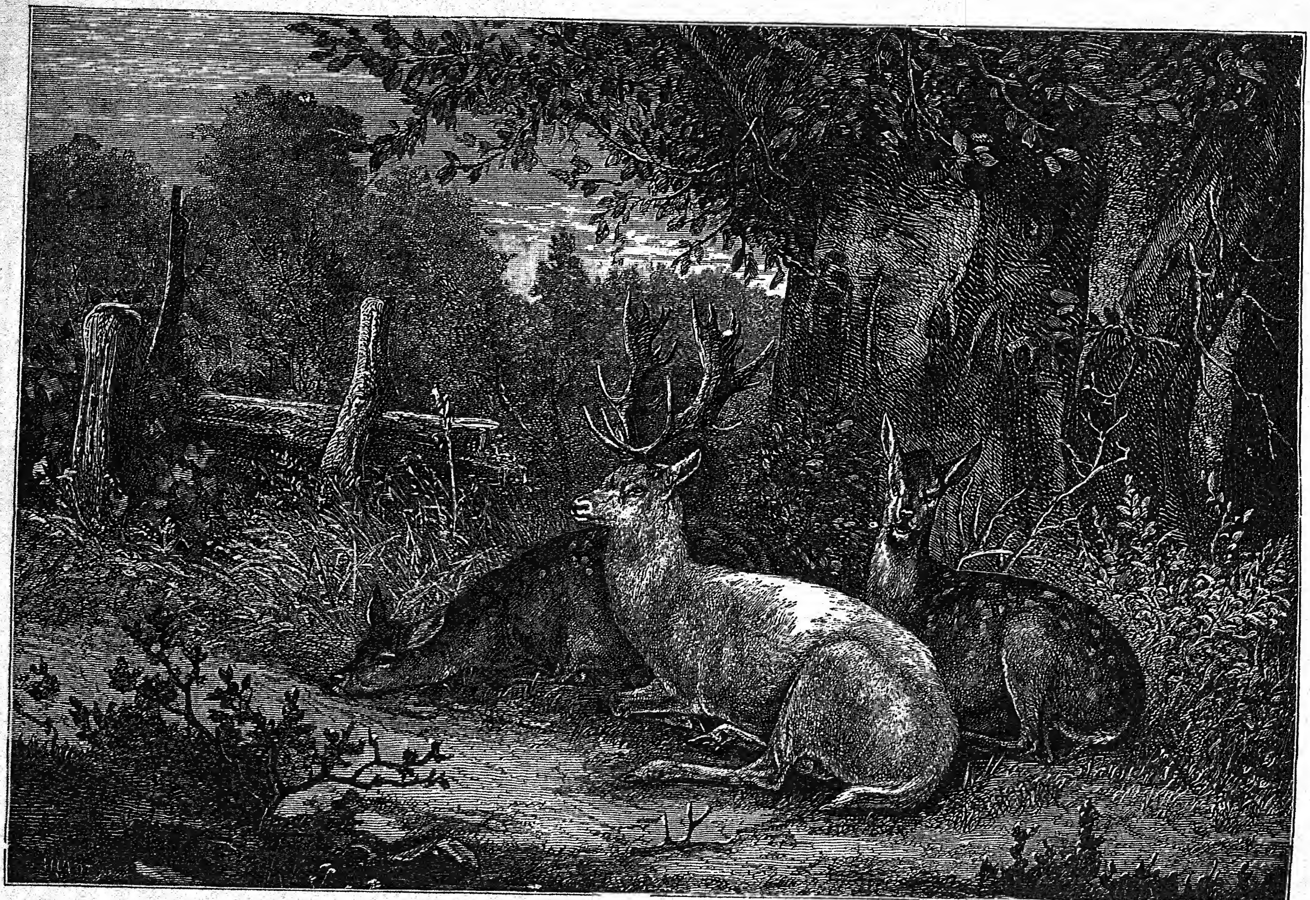
Travelling in the interior is unpleasant, but it only requires a good administration to open up these countries as the best stocked game districts of Europe.

In Turkey guns are admitted free, and in nearly all the large towns Eley's ammunition may be obtained, and a good gunsmith's shop found.

ASIA.

ARABIA, SYRIA, AND ASIA MINOR.

In Arabia, the only districts suitable for European sportsmen are on the confines of Syria, or the south-western provinces of Yemen and Aden. In the hilly country the Wild Goat, the Musk Deer, the Fox and



The Fallow Deer (*Cervus Dama*).

the Panther are to be found. Jackals, Wolves, Hyænas and Panthers also follow the tracks of caravans across the deserts. Gazelle are numerous, and can generally be flushed from shaded and isolated *wadis*. In Yemen and Aden there are many Monkeys. On the plains the Wild Ass and the Ostrich are numerous, and in Yemen there are species of Jungle-fowl, Pheasants, and several kinds of Pigeons. Along the Red Sea, Pelicans and various kinds of Sea-fowl are plentiful, and Quail and Snipe to be had in the winter.

In Palestine there is very little sport: Francolin Partridge, Hares, Snipe, Bustard and Gazelle are the most an ordinary sportsman can expect.

In Phœnicia the game improves in quantity, but there is not much variety. Woodcock may be added to the above list. The Valley of the Orontes is well stocked with small game, and in the Nahr-el-Asy mountains a chance at Ibex may offer. Around Latakia sport is plentiful, especially at Quail, Woodcock and Snipe, the latter often being found amongst shingle and other unlikely ground. From the Orontes to the Euphrates game is particularly numerous. Aleppo is the centre of a good district for small game; but eastward, down the Euphrates Valley, large game is found, and all kinds are fairly plentiful.

Further north, in the *Taurus Mountains* to the north of Seleucia, large and small game are abundant. South of Seleucia the large game is rarely met with, but small game is plentiful. The large game referred to consists of the Ounce or Spotted Panther, Bear, Lynx, Ibex or Mountain Goat, and a small variety of Chamois. On the plains are found Red, Roe, and Fallow Deer. Some of the Deer are occasionally met with as far south as Alexandretta. Near Adana, Deer are also plentiful, and in the forests on the banks of the Pyramus (Geihoun) are to be found Wild Boar and other game in abundance. The water-sheds of the Geihoun and Seihoun Rivers literally teem with Partridge (*P. francolinus*) and small game. Game is also to be found inland, and successful excursions may be made from Adana in an east-by-north direction.

Game may be considered plentiful throughout the provinces of Konieh and Aidin. Going up the west coast towards Smyrna, short excursions inland are usually successful in finding game. On nearing the north coast game becomes more scarce. In the neighbourhood of Besika Bay it is,

as may be imagined, scarce; but excursions of five or six miles inland, and ten or twelve either way along the coast, will enable the sportsman to shoot both large and small Bustard, Hares, Partridges, Woodcock, Snipe, Quail, and other small game. Quail is most abundant in season; but all over Asia Minor Partridges are plentiful, and bags of twenty Woodcock can often be made in one day; and as many as forty-five couple of Snipe are recorded as having been killed by one gun in the Orontes Valley.

On the shores of the Bosphorus game is more scarce, but Partridges and Woodcock can usually be counted upon.

On the northern coast, along the shores of the Black Sea and in Circassia, in addition to the usual small game of Asia Minor, are to be found Roe-deer, Ibex, European Chamois, Brown Bears, Wild Boars, Wolves and Jackals; also Pheasants; and on the higher ranges Blackcock and Ptarmigan, but these are not plentiful. This district is easily reached by steamer weekly from Odessa, and offers many inducements to sportsmen, who must, however, be prepared to rough it, take everything necessary with them, and get a "firman" from Constantinople, which will prevent molestation or interference from officials. Shooting is free. October and November are the best months, and in the northern districts all the winter and spring are healthy and enjoyable. August and September are uncomfortable and dangerous months for Englishmen.

CHINA.

The game of China, although plentiful, is not in great variety; and, owing to the difficulties attending travel in the interior, it is almost inaccessible. Speaking in a wide sense, game is less plentiful in Northern China than in the South-western. *Thibet* is a fair hunting-ground, and notes on that region are included in those for Hindostan.

Tigers (*F. tigris*) are pretty general throughout the interior; the skins are beautifully marked, and the hair is longer and finer than that of the Indian Tiger. In Mantchooria the Tigers are particularly long-coated, and some naturalists contend that they belong to another variety. The difference, however, is doubtless owing to the climate.

Tigers are sometimes to be had on the hills to the north of the Yang-tse-Kiang River; the mountains south-west of Pekin; in the Ala-Shan Mountains; in Mantchooria; and in the Yun-Nan Mountains in the south.

Bears are common in the hilly woods of Chan-si, west of Pekin.

The woods of Southern China are frequented by fierce Wild-cats. The Hog-deer (*Moschus*) is common on most of the plains, as is also the Hare. There are numerous large Hawks and Kites, which are frequently trained by the Chinamen to catch Hares, Pheasants, and other game. This is chiefly practised in the western districts, on the sandy plains near the hills. This sport is not patronised by the wealthy, but often pursued by the peasant as a means of getting food.

We illustrate Chinese Hawking as it gives a fair idea of the ground to be traversed in search of game.

Wild-pigs are pretty general throughout China, but the chief attraction for English sportsmen are the numerous pheasants (*P. torquatus*), and Wild-fowl. Quail, Snipe, Woodcock and Partridges (*Bambusicola thoracica*) are also to be met with in fair quantities.

The mouths of nearly all the rivers fairly swarm with Wild-fowl, and the large, shallow, muddy pools teem with Geese, Ducks, Teal, and other varieties of Water-fowl.

The Chinese have an original and effective manner of "pot-hunting" after Wild-fowl. Collecting a number of "jingals" from his associates, the Chinaman arranges them on a small flat-bottomed scow, so that some sweep a few inches above the surface of the water, and others at an elevation, to get the birds on the wing. He then cautiously enters the shallower lagoons, pushing his battery before him, he himself wading and often immersed in mud and water to the shoulders. The effectiveness of the device may be imagined. If at all successful, he gets a sitting shot, and fires the whole battery almost simultaneously. If the birds rise unexpectedly, he fires the elevated guns only, and the proceeds of a day's "jingal-shooting" is generally enough to keep half-a-dozen Chinamen's families a week.

A clever device is resorted to by the Chinaman which is worthy of mention. On the ponds waves of a considerable size are sometimes encountered, and as the guns are low in the boat, they are often partly immersed. To prevent the barrels from filling with water, the Chinaman

Hare-hunting in China.

fastens against the muzzles three or more small feathers; these effectually prevent the water from entering, and do not burst the barrels upon the gun being fired, although neither the thickness or quality of the jingal barrel is equal to that of the commonest English guns.

In Hong Kong the only game is Pheasant, Snipe and Water-fowl, with the small Deer before mentioned. At Canton there are Wild-fowl, and these are more or less frequent along the coast. Ningpo is a famous resort for them during the cold weather. The Yang-tse-Kiang River is, however, the best for shooting trips. Near Shanghai, Wild-fowl are plentiful, especially in winter. The Ningpo River and Hang-chow Bay in the winter are alive with Swans, Bernicle, Grey and other Geese, Ducks, Teal, Coots, Cranes, and endless smaller fry. The Yang-tse River as far as Hankow is alive with Ducks, and the numerous lakes and lagoons in its neighbourhood abound with Geese, Mandarin Ducks, and other Water-fowl. Lakes Taiho and Yang-ho, in the neighbourhood of Nankin, Foo-choo-foo, and Situng, but more especially in the districts of Maichee and Tatà-Jao, fair sport is to be had at Wild-pigs, Deer, Pheasants and Wild-fowl, with occasional chances at Quail, Snipe, Woodcock and Partridges.

A good 10- or 12-bore gun is best for Chinese sport; No. 5 shot is as good a size as can be taken, it being sufficiently large to bag the Deer and Pig up to thirty yards. Dogs are very valuable, and should be taken; a retriever or spaniel is best suited, and small-arms may be carried, as at distances from Shanghai or Nankin the Chinese make themselves very offensive to all foreigners. We are not aware of any licenses being required for shooting in China, or of any close season; the best time, however, for sport is from September to March.

SIAM, CAMBODIA AND COCHIN CHINA.

Game in these countries is plentiful, the difficulty is its inaccessibility. A great deal of the country has never been traversed by Europeans, and native accounts cannot be relied upon.

From Bangkok in Siam, excursions may be made into a fine game-district; Elephant, Rhinoceros and Bison are plentiful; Deer (Spotted Sambur, Muntjac and Mouse), are to be had in abundance.

Birds are in every variety: Quail, Pea and Jungle-fowl and Snipe being particularly numerous. Very fair sport is also to be got near

Saigon, but not without difficulties. Wild-fowl are particularly numerous at the mouth of the Meikong River.

Buffalo and game, large and small, is plentiful near Saigon this year, and the countries, when a little more accessible, will rank amongst the best hunting grounds of the world.

PERSIA.

In Persia game is plentiful in some districts, but when it is remembered that Persia has several deserts, and that the greater part is an arid waste, it will not be deemed a desirable place for sportsmen, or offering special inducements for any one to prefer it before more accessible districts.

In eastern Persia, the fertile tracts near Lake Siesian have plenty of game, and in the Elzeburg Mountains it is not scarce.

The game of Persia consists of Lions and Tigers, Maral and Roe Deer, Ibex, three species of Gazelle, two of Wild Sheep, Wild Pig, Bustard (*Otis Houbara*), Pheasants; Grey, Red-legs, and Francolin Partridge; Quail, Tihu (*Ammoperdix bonhami*), Woodcock, Snipe and Duck. On the shores of the Caspian are also to be obtained the Caspian Grouse, and several varieties of Waders and Waterfowl.

Travelling in Persia is difficult, monotonous, expensive and wearying. The people are neither civil or accommodating, and at present the trouble of a visit to the country would not be compensated by the amount of game likely to be bagged. Naturalists and explorers may be interested to know that over 560 varieties of fauna are said to exist in eastern Persia alone.

AFGHANISTAN, BELOOCHISTAN, TURKESTAN AND SIBERIA.

In Afghanistan the game to be found is similar to that found on the Indian frontier. Very fair sport is to be had near Ghuznee and Kandahar. For shooting in the Hindoo-Koosh, see Notes on India.

In Beloochistan game is far less plentiful. Gazelle (*G. benettii*) are numerous, and the *Otis Houbara* or Bustard is frequently to be found in cover, and on some of the plains. Ibex (*Capra ægagrus*) are to be found in the hills, this species of goat being found throughout the Indian plateau.

In Turkestan game is not plentiful, and difficult to obtain. There are Bears, Goats, "Houbarehs" or Bustards, a few Quail, and smaller birds.

In Siberia, Bears, Lynxes (all over), and Yaks and Wild Sheep in the south. This vast country, with those before mentioned, is not yet opened up to the sportsman.

JAPAN.

These islands abound with Wild-fowl, and Duck-shooting constitutes the chief sport of the empire. Most of the princes have, however, herds of Deer, and permission to shoot is easily obtained.

In the interior—chiefly the Islands of Niphon and Sikok—is found the Nik (*Capricornis crispus*); it affords fair sport, but to obtain it a long excursion into the interior is necessary, and the sportsman must be prepared to rough it. Pheasants are to be found in Niphon, Knishu, and Sikok, but are not plentiful. There are also Quail, Snipe, and Wild-fowl in abundance. In winter Nagasaki and Yokohama are good Wild-fowl resorts.

There is no use for a rifle, unless Deer-shooting is intended, and a 12-bore will answer well for ordinary purposes. A consul's permit will pass the sportsman anywhere.

MALAY PENINSULA AND THE STRAITS SETTLEMENTS.

Shooting in the Straits Settlements amounts to very little. At Malacca, shooting, with the exception of Snipe and Sea-fowl, may be considered a myth.

In the neck of the Peninsula, game of all kinds is scarce, at least it is so reported by two gentlemen who travelled from Siam to Malacca. In the Wellesley Province, game again becomes more plentiful, and good Snipe-shooting is to be had. The Deer most plentiful is the small Mouse-deer or Chevrotain. Tigers are not plentiful, nor Elephants. Of Bison (*Bos sondaicus*) there are several good herds to be had in the interior. Rhinoceri are not unfrequently met with. Leopards and Tigers are to be found, but in many districts are scarce.

A good sporting district is said to be at the head of the Moar River. This district, called Sagamet, may be reached in a steam-launch or "prahu."

Quail (Chinese) are to be found more or less throughout the peninsula, as well as Jungle-fowl and Snipe; Teal, Duck, and Wild-fowl in the wet season. Pigeons of two or three kinds are distributed throughout the interior, but cannot be considered plentiful.

In the Perak Province, small Deer and birds are practically the only game.

At Penang and Singapore, small game is to be had, and in the last-named, Tiger. These settlements are but little known, only half-explored and no reliable history of their fauna has yet been compiled. Outfit same as for India.

GENERAL HINTS ON SHOOTING IN INDIA,

Including information as to the localities where game, both large and small, may be found.

India is so large a country, and its vast physical features involve such a difference in climate and consequent variety of fauna, that it is difficult to give, within reasonable limits, advice and information which shall be suited to all cases. Some men are ambitious of slaying tigers, buffalo, and bison; others would be satisfied to stalk the wily antelope, and shoot snipe and duck; and again, men will be found who would prefer shooting the ibex and bear, with a chance of an ovis ammon, on the Hĭmālyas. If a shooting trip of from three to six months is contemplated, the best thing to do is to enter into correspondence with a friend in India, who, even if not a sportsman himself, may have friends who will afford information and advice. Failing this, the next best thing is to obtain good introductions. Without friends or introductions, a stranger might be in the middle of a country abounding in game, and yet have no more chance of sport than he would of reaching land if cut adrift in a small boat without a compass in the middle of the Atlantic. Wherever good shooting is to be had, the civilians and military men of the stations in the vicinity have the pick of it; and, from their influence in the district, and knowledge of the people and language, will get information as to game which no outsider could procure. There are, however, no men more willing and anxious than the Anglo-Indian to show sport to a stranger; and if he has good introductions, and proves himself a good fellow, he will not only be received with the utmost hospitality, but the greatest exertion will be used to show him sport. The best, though not the cheapest, way to go to India is by the P. and O. steamers; and on board these vessels it is very probable that the sportsman will meet congenial spirits who can put him in the way of enjoying his favourite pastime, and give him many a useful wrinkle.

Murray's Guides to the different presidencies will be found most useful

books, but must not be implicitly relied upon as to the best places to go for shooting.

The pleasantest time to visit India is during the cold weather, between October and February; but it is by no means the period to choose to shoot large game. The hills in Cashmere and the Hĭmālyas are at this time practically closed to the sportsman, as the snows commence about November, and the passes are not open until March at the earliest. The *Felidæ* cannot be hunted with success except during the hot weather, when they are driven by the heat into jungles bordering rivers or adjacent to water, where also, at the same time, the different kinds of deer assemble for the sake of shade and water. The same may be said of the bear (*Melursus labiatus*), which during the cold season wanders about the jungles that afford sufficient shelter from the sun. It is, under such circumstances, quite a chance meeting them; whilst in the hot season they invariably resort during the day to caves, and may then be shot either by sitting over the caves at daylight, or later on in the day driven out of their dens by rockets.

During the cold weather the bison (*Bos gaurus*), the sambur (*Rusa aristotelis*), and the Neilgherry ibex (*Capra hylocria*) may be successfully stalked on some of the hills in Southern India, at a height above sea level which makes them safe from malaria, and where a perfect climate may be enjoyed. Even at this season, in some places above referred to, the grass is too long and coarse either for the animals to eat or for the sportsman to stalk. For small game shooting, the months between October and February are the best. Snipe, duck and teal may be found in great numbers at almost any place throughout the country; and there are many spots where a good shot ought to account for fifty couple of snipe in a day. Of course a locality must be chosen sufficiently far away from large towns to ensure that it is not worth the native shikaries' while to kill or snare for the market. The antelope (*Antelope bezoartica*) can also be got at this season, although in certain parts the crops are too high for successful stalking. Still, sufficient sport can be had to make it worth while going after them, and there is no sport so fascinating to a tyro. The game is nearly always in sight, and that is one reason. There are few animals more difficult to approach than an old black buck, and few handsomer when brought to bay. The antelope is rare in Bengal, and

does not occur on the Malabar coast. It is abundant in the Deccan, in the tract known as the Doab, between the Jumna and the Ganges, and also in Hurriana, Rajpootana, and neighbouring districts.

Tents.—For use in the plains, the tents made in England are unsuitable, because the material used is nearly always canvas, which is so heavy that if a tent was made of it of two or three thicknesses, and double walls and roof to keep out the heat of the sun, it would be too heavy and cumbersome to carry about conveniently. In India, tents are made of four folds of very light cotton material, with double walls and roof 2 feet 6 inches apart—in fact, a tent within a tent. They are admirably suited to keep out heat; and at night, in the hot weather, the walls can be removed to admit any breeze there may be. A single-poled tent such as I have described, and 12 feet square inside, will cost from £40 to £50, and is indispensable if shooting is to be done on the plains in the hot weather. This should be supplemented by a sleeping pâl, which is a single stretch of canvas or cotton, four folds thick, passed over a ridge-pole support on two uprights. The ends are open, but can be closed when necessary. It will be found useful either when camping out for a single night away from head-quarters, or to use as a sleeping-tent when the large tent has been sent on to a new camping-ground. This pâl will cost from £8 to £10.

A Routié for your servants is a small pâl, but is absolutely necessary to keep them from exposure and consequent fever. The Routié costs about £5. The best tents are made at Jubbulpore, where there is a large manufactory, but they can be hired at many of our large stations.

Wherever there are roads carts can be had, and the best way is to hire them for the trip, or by the month, and thus be independent of the villagers, who will frequently decline to transport your camp more than a single march from their homes.

Where there are no roads, camels, pack-bullocks or ponies, called tats or tatoos, can generally be procured. A full-sized bullock-cart will carry from 800 to 1,000 lbs.; a camel, 300 to 400 lbs. It will be self-evident that such tents as I have described above are totally unfitted for hill-shooting, where everything has to be carried by men, and the loads calculated to a pound, and where, because of the difficulty in getting men, your kit must be cut down as much as possible. The best sort of tent for hill-shooting is a double-poled tent, 6 feet 6 inches between the poles,

6 feet wide, and 7 feet high. By having the walls two feet high, you gain a good deal of extra room. Each end of the tent should lace up, so that during the day ventilation may be secured. An arrangement by which a single fold of canvas should go over the whole, with a space between it and the ridge-pole of nine inches, and reaching to the ground on each side, will give you a tent that will keep out either heat, cold or rain, and the weight of the whole should not exceed 50 lbs. For such a tent, I should go to Mr. Benjamin Edgington, foot of London Bridge. One of his "tentes d'abris," and swing-cot combined, would also be most useful when you wanted to travel very light, and, indeed, with an extra cover, as described above for the hill tent, this "tente d'abri" alone would be quite sufficient for a short hill trip. The only drawback to Mr. Edgington's special tents for hill-shooting is their weight; in every other respect they are admirable, being both roomy and sturdy. It should always be borne in mind that 40lbs. is the limit a hill-man will carry, and if you want a contented set of carriers few of your loads should exceed 30 lbs. All should be made as compact as possible, and no load should require two men to carry it; nor should any load, however light, exceed four feet in length, which is the limit of a manageable parcel over such ground as you are likely to traverse. It is most important to have two waterproof sheets with you, and, whatever may happen, keep them always with you. They should be 12 by 8 feet, with eyelet-holes along the edges. On the march, should unusual rain prevent you and your party advancing, you can cover your loads with one, and either pitch the other like a tent, under which you and your people can take shelter, or sit on one side, and pass the other over your head, supporting it with sticks, and making a comfortable hood. Cooking utensils should be as simple as possible. Those made for the army, where there is an external bucket, into which each article fits in the shape of a sector of a circle, are unsuited to the Hindoo, who would resent having to pack them up each day. He would prefer throwing them altogether loose into a basket, and by the end of the trip you would find half the things lost. The usual cooking-pots in India are made of brass or copper, and it is usual to have a nest of these fitting one inside another. The objection to these is that you run the risk of being poisoned, from the carelessness of your servants in not cleaning them properly; or, on the other hand, if they are what is called "kallied," that

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A Routié for your servants is a small pâl, but is absolutely necessary to keep them from exposure and consequent fever. The Routié costs about £5. The best tents are made at Jubbulpore, where there is a large manufactory, but they can be hired at many of our large stations.

Wherever there are roads carts can be had, and the best way is to hire them for the trip, or by the month, and thus be independent of the villagers, who will frequently decline to transport your camp more than a single march from their homes.

Where there are no roads, camels, pack-bullocks or ponies, called tats or tatoos, can generally be procured. A full-sized bullock-cart will carry from 800 to 1,000 lbs.; a camel, 300 to 400 lbs. It will be self-evident that such tents as I have described above are totally unfitted for hill-shooting, where everything has to be carried by men, and the loads calculated to a pound, and where, because of the difficulty in getting men, your kit must be cut down as much as possible. The best sort of tent for hill-shooting is a double-poled tent, 6 feet 6 inches between the poles,

6 feet wide, and 7 feet high. By having the walls two feet high, you gain a good deal of extra room. Each end of the tent should lace up, so that during the day ventilation may be secured. An arrangement by which a single fold of canvas should go over the whole, with a space between it and the ridge-pole of nine inches, and reaching to the ground on each side, will give you a tent that will keep out either heat, cold or rain, and the weight of the whole should not exceed 50 lbs. For such a tent, I should go to Mr. Benjamin Edgington, foot of London Bridge. One of his "tentes d'abris," and swing-cot combined, would also be most useful when you wanted to travel very light, and, indeed, with an extra cover, as described above for the hill tent, this "tente d'abri" alone would be quite sufficient for a short hill trip. The only drawback to Mr. Edgington's special tents for hill-shooting is their weight; in every other respect they are admirable, being both roomy and sturdy. It should always be borne in mind that 40lbs. is the limit a hill-man will carry, and if you want a contented set of carriers few of your loads should exceed 30 lbs. All should be made as compact as possible, and no load should require two men to carry it; nor should any load, however light, exceed four feet in length, which is the limit of a manageable parcel over such ground as you are likely to traverse. It is most important to have two waterproof sheets with you, and, whatever may happen, keep them always with you. They should be 12 by 8 feet, with eyelet-holes along the edges. On the march, should unusual rain prevent you and your party advancing, you can cover your loads with one, and either pitch the other like a tent, under which you and your people can take shelter, or sit on one side, and pass the other over your head, supporting it with sticks, and making a comfortable hood. Cooking utensils should be as simple as possible. Those made for the army, where there is an external bucket, into which each article fits in the shape of a sector of a circle, are unsuited to the Hindoo, who would resent having to pack them up each day. He would prefer throwing them altogether loose into a basket, and by the end of the trip you would find half the things lost. The usual cooking-pots in India are made of brass or copper, and it is usual to have a nest of these fitting one inside another. The objection to these is that you run the risk of being poisoned, from the carelessness of your servants in not cleaning them properly; or, on the other hand, if they are what is called "kallied," that

is, tinned, you run the risk of being lead-poisoned, as the tin is largely mixed with lead.

The cooking things best suited for India are made of block tin, and should be procured in England. The external tin should be 15 inches long by 10 broad and 12 deep, something like what is known as a fish-kettle. The lid of this is to be convex on the outside, and makes an excellent frying-pan. A gridiron can be made to fit inside the frying-pan. The length of the outside tin is sufficient to allow a double nest of saucepans plenty of room. Inside one of the saucepans, a small tea-kettle with a short spout can be fitted, in which not only can water be boiled, but, by having a strainer fixed, tea can be made. All the saucepans should have triangular slots fixed on the outside, the acute angle of these slots being nearest the rim of the saucepan. A corresponding iron to fit the slots is fixed to a wooden handle, of which there should be two, and the saucepans can thus be moved at pleasure.

An iron spoon, with teeth on the lower end, like an old-fashioned pickle-fork, will be found useful, both as a spoon and also to fish up meat from a saucepan. Four tin plates, the size and shape of soup plates, should find a place. These plates must be fitted with brass D's on the outside of the rim, so that two will make a cover-dish. Hollows should also be punched on the edge of each plate for salt and pepper. A kitchen knife, and a good-sized pewter case to hold mustard, salt, and pepper, may with advantage be added. The whole should be packed in an osier (not bamboo, which is too pliable) basket, and will not weigh 20 lbs., and you have a "batterie de cuisine" equal to any emergency. The great advantage of the large external boiler is that, in case your coolies, from whatever cause, should not have cooking-pots with them, they can always cook a mess for the lot in it. This is no light matter when you are out of the pale of civilisation, for much of your comfort depends on your coolies or carriers. When these happen to be aborigines, they are frequently as helpless and dependent as children; and as they are despised and bullied by your servants, if not looked after by you, will either run away, or probably without your knowledge go on carrying loads whilst in a state of semi-starvation. There are no people in India so simple, faithful and uncomplaining, as many of these despised jungle-men. They are shy, and in the first instance it is often most difficult to get hold of them. They prefer being left to them-

selves, and do not care to be brought into contact with Europeans. They are afraid that, should the sahib come to grief, they may get into trouble; they would certainly have to attend some sort of court to give evidence, and of this they have a horror. Then, again, most men allow their servants to pay the coolies, and I need hardly say that in the East money cannot pass through a native's hand without sticking. It is well known that some of these aborigines have led men who have come from England for sport round and round herds of elephants without taking them up to them, and this from fear that, through ignorance or rashness, they might fail to bag, and be injured or killed in a charge. Sometimes these men will desert you without any apparent reason, but they may have heard of the illness of a relative or the arrival of a creditor (they are always in debt), and although it is most irritating and provoking to be thus left, the best thing you can do is to receive them when they come back as if you were not a bit put out. Above everything, avoid striking, or allowing others to strike, one of these jungle-men, for if you do, farewell to all chance of ever getting any of them to accompany you. For duck shooting in tanks or large ponds, which in the season are covered with wild ducks of all sorts, a Berthon or McDonald's folding boat would be found most useful.

Clothes.—Four suits of light duck, consisting of a single-breasted, rather loose jacket, coming down three or four inches below the hips, and trousers loose to just below the knee and tolerably tight from that down will be useful, as also a couple of pairs of knickerbockers. These should all be dyed a neutral tint (olive-colour is good). In India we do this with a mixture of the Babool (*Acacia Arabica*) bark and Mango bark. If possible, it should be done by a regular dyer, as the efforts of amateurs sometimes produce an effect more startling than satisfactory. Knickerbockers are the best nether garments to wear, either for hill-work or snipe-shooting, but in the jungle trousers are better, as you can get along without making a noise or catching in the bushes. Your coats should have a triple fold of flannel three inches wide sewn down the centre of the back. This will be found a first-rate protection against the sun. Of course your shirts should be of flannel, and there is no use in getting them too thin. It is a matter of taste whether you have collars of the same material or not. When out shooting even for the day, an extra shirt, pair of socks, and towel

should be taken, as there is nothing more refreshing after a hard morning's work than to change your under-garments, which are pretty sure to be soaked, and sit down for a couple of hours in the middle of the day under a shady tree. Your hose should be of tolerably thick hand-knitted wool. As to boots, a pair of the "Field" boots will be found most useful. In addition to these, two or three pairs of lace-up or mocassin shooting boots (and no one in London makes these better than Fagg, of the Haymarket) should be taken. The soles must not be double or clumped; strong single soles are best. Two pairs of canvas shoes with corrugated india-rubber soles will be found invaluable for stalking. If you happen to have a couple of suits of thin home-spun wool, don't leave them behind, as they will be found useful, and a "Cardigan," or knitted waistcoat, is a first-rate thing to have when you are shooting on the hills. A pith helmet covered with waterproof felt is as good a head-covering as any; but take care not to have india-rubber ventilators, which give out in a very short time; and also be sure that the hat covers the temples well. You should have a cover for your hat of the same material that your suits are made of. Gaiters to wear with knickerbockers should be made of No. 2 canvas, and dyed to match them. Waterproof gaiters are useless. A good thick Scotch plaid is indispensable, and can be used either by day or night. A very light and very loose waterproof coat should also form part of your outfit. Two suits of flannel (pyjames and jacket) ought to be taken for camp use, and a dozen sets of the same pattern, but of thin cotton. You require a good double-draw telescope for hill-work. This will be carried by your attendant, so that you need not have it too small. Your binoculars should always be carried by yourself, and should, therefore, be light and compact. The case should be made to take the object glass downwards (exactly the opposite of the usual way of carrying them), and be deep enough to allow the glass to be carried focussed. The cover should be attached to the sling, and requires no fastening, as it will always drop into its place. A compass should be inserted in the cover; the best kind is that known as the day and night, one half being white and the other black. There is no maker in England who can turn out better glasses of the sort described than Messrs. Burrow, of Malvern.

An aneroid is sometimes useful, but unless a man understands how to use it, it is useless as a scientific instrument. The same may be said of the boiling-point thermometer.

A hunting-knife of Colonel Shakespeare's pattern, but heavier, is very useful for a variety of purposes, but chiefly to cut your way in a thicket. The best skinning-knives are small ones, the same pattern as butchers use. They should be thin, and of soft steel. Three pairs may be taken, each pair in a leather sheath, with a steel for sharpening attached. A roll-up leather case, containing tools fitting into the same handles, will always turn in handy. The tools in such cases are generally too highly tempered.

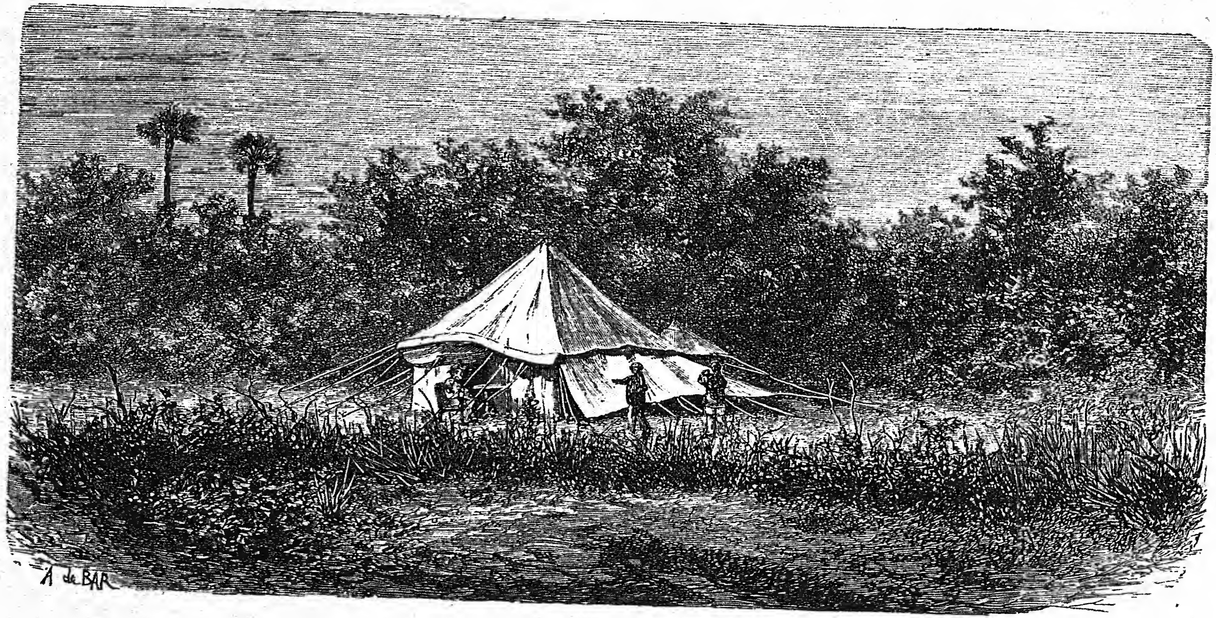
For shooting on the plains nothing but a mamoty, a crowbar, a mallet, and a couple of axes are required, and these can all be had in India. For the Hills it is well worth while to have a small leather bag, the shape and size of a cricketing-bag, and this should contain a couple of mamoties, a shovel, short crowbar flattened out at one end and sharp at the other, a couple of axes, billhooks, small miners' picks, three or four cold chisels, and a couple of augers.

These tools are a light coolie load, but they will be found invaluable for cutting a camping-ground out of the side of a hill, and for hutting both yourself and attendants.

As Ceylon is the nearest point of what we call the East to England which is touched at by a sportsman bound for India, it may be as well to say a few words as to the fauna of the island. Every one knows that elephants are found there, but it is not so generally known that tuskers are so rare that not one male in 300 has tusks. The elephant is protected by law, and none but rogues can be shot without permission. I believe, however, that it is not difficult to get an order to shoot a single animal, should any sportsman be anxious to kill an elephant, the only trophy of which would be a tail and feet.

The Indian Black Bear (*Melursus labiatus*) is also to be found in suitable localities. There are no tigers in Ceylon; but the Leopard (*Felis pardus*) is occasionally extremely troublesome to planters, but there is no animal more difficult to get a shot at—in fact, unless under very exceptional circumstances it is waste of time looking for them.

There are no Bison (*Gavæus gaurus*) in Ceylon, but there are great



The Sportsman's Camp.

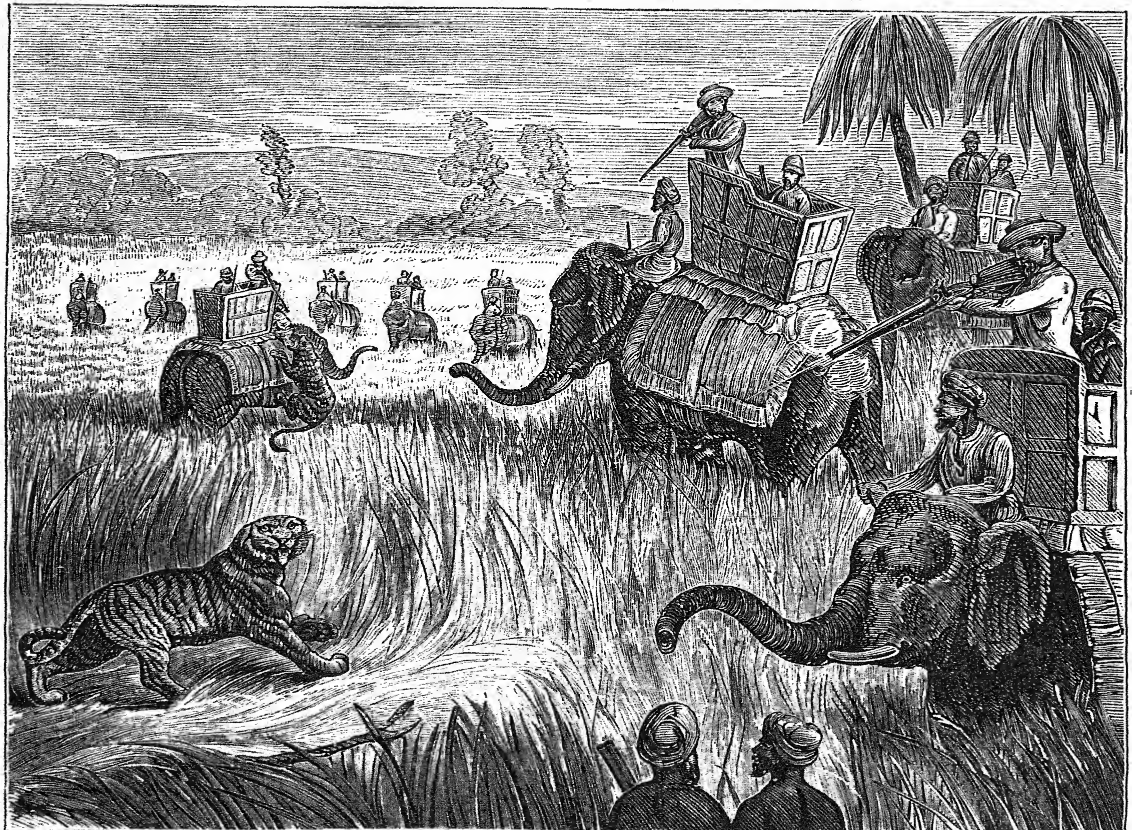
numbers of buffaloes, the same species as those of India, found in the swamps. It may here be noted that no animal in the world takes such a lot of killing as a buffalo, and it is the opinion of many experienced sportsmen that the largest bore rifles or guns should be used for this sport. Of the Cervidæ, there is the Sambur (*Rusa aristotelis*) found chiefly on the higher ranges; but, as at Neuralia Ellia, it is run down by dogs, and knifed when brought to bay. It is there considered as sacred from the rifle of the sportsman as the fox is in England. The horns of the sambur in Ceylon run very small when compared with those of the same animal in India. Besides the sambur, there is a form of spotted deer peculiar to the island (*Axis oryzeus*). The Rib-faced, or Barking Deer (*Cervulus aureus*), called in Ceylon the red hog deer, is also found, as also the Mouse Deer (*Memimna indica*), a diminutive little animal not much larger than a hare. The lakes and swamps abound during the cold season with a great variety of ducks and teal, and snipe also are found in great numbers.

Supposing a sportsman landed in India, his first and fixed resolve and greatest ambition is, of course, to kill a tiger. Now, although tigers are found from the extreme south, up to 6,000 or 7,000 feet on the Himalayas, it is not always easy to get them.

They are probably more numerous in lower Bengal than elsewhere, and are there found in the heavy grass, jungles and swamps, where they can only be shot from elephants. In all parts of the country the hot season—March, April, and May—is the best, and in most cases during this time is the only chance of getting a tiger. At this season of the year the country is burnt up, and both tigers and the animals they prey on are found near rivers, or pools left by what were once rivers. In many places where elephants are not procurable, the only plan is to beat out the jungle with a strong band of beaters with tom-toms, fireworks, &c., the guns being posted in the most likely places.

This method, however, is open to the objection that the tiger frequently breaks back and injures or kills some of the beaters. In some places where there are no large trees, and nothing but the tall branchless palmyra or date palm, some men find a light bamboo ladder, about twelve feet long, useful to enable them to see the tiger as he makes his way through the tall grass or thick shrubs.

Another plan is to tie up a young buffalo, or, better still, several of



Tiger Shooting.

them; when one is killed the tiger may either be tracked up to his lair, which is sure to be pretty close, and shot from the back of a staunch elephant, or, if no elephant is available, *mechaums*, which are platforms erected on trees, may be built. In the latter case the sportsman should be in his place—which should be thoroughly comfortable, and have a thin mattress spread—not later than 3 p.m. There is no use waiting later than dusk, at which time the sportsman's attendants may be directed to meet him with lanterns or torches to accompany him to his quarters. All authorities agree in condemning, as disappointing and generally useless, the practice of sitting up at night for game of any sort. For further particulars of tiger shooting the reader is referred to Rice's "Tiger Shooting in India," Forsyth's "Highlands of Central India," Baldwin's "Large and Small Game of Bengal," "Seoni," and Sanderson's "Thirteen Years amongst the Wild Beasts of India."

With regard to the weapon most suitable for tiger shooting, Rice shot nearly all his with 12 or 14 smooth-bores; Forsyth advocated a 12-bore shell rifle; and many men consider a ·450 Express sufficiently powerful. The present writer believes that if a ·450 Express has a bullet and charge of powder suited to each other, and to the rifle, the hollow in the bullet properly regulated, and the bullet itself slightly hardened, that a ·450 Express, if held straight, will account for any tiger.

Next to the tiger the Indian Bison (*Garæus gaurus*) is probably more sought after by sportsmen than any other animal of the plains. By the term "plains," I mean to convey that the bison is not an animal inhabiting the higher mountains, such as those of Cashmere and Himalayas. They, however, love a hilly country, and their favourite haunts seem to be from 2,000 to 3,000 feet, although they freely ascend to 6,000 feet when the grass is suitable, or when driven by the heat or flies from lower elevations. The bison is the largest of Bovidæ, standing from nineteen to twenty-one hands high, and the horns of the bull have been measured over forty inches across. The bison is found along the western ghâts from Bombay to Cape Comorin, and as far north as the Vindhya Mountains and Chota Nágpúr. It is also found, but in small numbers, in the hills of eastern Bengal. In the south it is found in the Canara hills, in the great Wynaad jungle, at the foot of and along the slopes of the Nilghiri hills, as also on the Pulney, Cochin, Travancore and Anamully hills. In the central provinces the bison is

found in the Satpura and Mahadeo hills. Bison can be either stalked in mornings or evenings, or, where the jungle permits of it, may be tracked up. The best sport is to be had with solitary bulls. They occasionally charge without provocation, and nearly always when wounded. Most men think a 12-bore taking five or six drachms of powder *the* weapon for bison, others that a ·577 Express is good enough. One of the crack shots of India, and not unknown in pigeon shooting at home, in the days when breech-loading weapons were not brought to their present perfection, gave up 12-bores for Bison shooting, and went back to muzzle-loading No. 8's. *Verbum sap.*

Next to the bison comes the wild buffalo, by universal consent the hardest animal to kill of all big game. They frequently without provocation charge down on an elephant, and have even been known to upset one! Large bores and heavy charges are absolutely necessary to be used against these animals. The buffalo is found in the swampy terai at the foot of the hills from Bhotan to Oude, in the eastern parts of Central India, on the plains of lower Bengal as far west as Tirhoot, and most plentiful on the Burrampooter and in the Bengal Sunderbunds; they are also found in the northern Circars of the Madras Presidency. In eastern Bengal the nature of the country is such that the best way to shoot buffaloes is from off an elephant. If you want excitement, get off your elephant and track up an old bull. The best places to fire both at bison and buffalo are, if the rifle be powerful enough, through the point of the shoulder; and if not, behind and a little above the elbow. The neck shot is always a deadly shot for all animals. It should be remembered that in firing at the chest of a buffalo a bullet has to pass through more than two feet of hide, bone and gristle before penetrating to the cavity of the lungs.

Of the Cervidæ, the Sambur or Gerow (*Rusa aristotelis*) is the best known. It is found in all the large forests throughout India, ascending the Himalyas to 10,000 feet of elevation. In forests the sambur is either driven out by beaters where that is possible, or, when the ground is unsuited for this unsportsmanlike mode of proceeding, he may be shot from an elephant, which should be thoroughly trained to stop when the deer gets up; and the shooter must then be pretty quick in firing, for the animal will not give him much time. The poetry of sport, however, is where the ground is suitable for stalking, and this sport is enjoyed in perfection on

the Nilghiri and Travancore hills, as well as on the Himalayas; and in fact at elevations where grass and forest are so combined as to allow the stalker a fair chance of approaching his game.

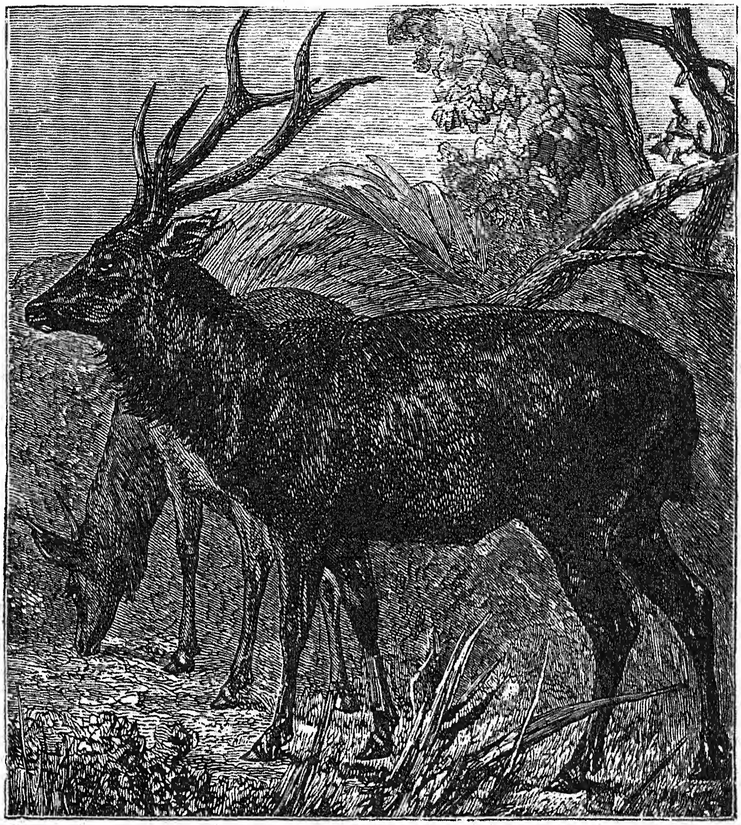
The Swamp Deer (*Rucervus Duvaucellii*) is another splendid animal of the deer tribe found in India. It inhabits the forest land at the foot of the Himalayas from Kyarda Doon to Bhotan, is abundant in Assam, and occurs in the Sâl forests of Central India. About the end of the rains in September and October they collect in larger herds on the tops of the plateaux, and are then easily approached. This animal is often erroneously called the Bara-singha, which name properly belongs to the Kashmer Stag (*Cervus Wallichii*).

The handsomest of all the deer tribe is doubtless the Spotted Deer (*Axis maculatus*); a really good skin, is as handsome as that of the leopard, and the horns are graceful trophies. It is found in the forests of Central India, and is very abundant on both sides of the Nerbudda. It is found in suitable localities along the western ghâts, never ascending hills to a greater height than 2,500 feet. This deer is also found in numbers in the Sunderbunds, and extends down the eastern ghâts to within a short distance from Madras. They are very gregarious. The spotted deer can be stalked early in the morning, and in the evenings, when it will be found feeding in clearings in the jungle.

The last of the deer tribe found in India Proper is the Hog-deer (*Axis porcinus*). It is found throughout the Gangetic valley, more rarely in central India. It seldom seeks shelter in forests, but prefers thick patches of grass, or bushes in grassy plains. No animal in India has had more powder fruitlessly expended upon it than the hog-deer. It is generally shot from an elephant, and from its small size and the nature of the ground it is found in, it frequently passes unharmed after receiving the fire of the whole line. It is easily bowled over by a charge of No. 3 shot.

The Barking Deer, or Rib-faced Deer (*Cervulus aureus*), although small should not be left out, as the venison is better than that of any other deer in India. It is found in all the forests of India, from the extreme south up to 10,000 feet on the Himalayas. It is solitary, and the male has long canine teeth in the upper jaw, and can wound a dog severely with them.

For all the deer tribe *the* weapon is doubtless a ·450 double Express



The Samlur Deer (*Rusa Aristotelis*).

rifle. It should not be less than 8 lbs. in weight, and half a pound more will be found to give more steadiness and regular shooting.

The only bear found on the plains in India is the Black Bear (*Melursus labiatus*). This animal is found from the south of India to the Ganges, chiefly in hilly and jungly country. No animal gives more sport, with a sufficient spice of danger to render hunting them pleasantly exciting. The black bear lies up during the day in caves and amongst rocks, and sallies forth in the evening to feed, which it does during the night, on white ants, beetles, fruits and honey. There are two ways of hunting this animal. One is to wait near their caves at daylight, and intercept them on their return home. The other and more satisfactory way is to track them to their lairs, and rout them out with rockets. Bears are to some extent gregarious, and three or four are often in the same cave. When suddenly disturbed by the introduction of a rocket, the roaring is tremendous, and disconcerting to a tyro, and when wounded even slightly they howl extravagantly. A female with cubs will frequently charge, and the shooting in such a case must be pretty straight.

A bear sometimes takes a good deal of killing, but a man armed with a ·450 Express, and a stout No. 12 smooth-bore or rifle of same gauge ought to be able to give a good account of such of this species as he may meet.

There are two species of rhinoceros in India: the great Indian Rhinoceros (*R. Indicus*), and the lesser Indian Rhinoceros (*R. sondaicus*). The large rhinoceros is found in the terai at the foot of the Himalayas, from Bhotan to Nepaul, and in Assam. The lesser rhinoceros is found in the Sunderbunds and in Assam, and thence down through Sylhet, the Garrow Hills, Tipperah, Chittagong, into Arrakan and Burmah.

The rhinoceros is usually hunted on elephants, and has been known to charge and overthrow an elephant. An elephant once wounded by one will seldom again approach a rhinoceros. Rhinosceri require a large-bore to floor them, but do not take as much killing as a buffalo.

Col. Pollok, in his book, "Sport in British Burmah," says the proper place to aim at is in the centre of the shield over the shoulder, rather low

down or behind the shoulder. The rhinoceros frequents swampy ground in forests and thick jungles, and is frequently found wallowing in a mud-hole. The horns, although useless as trophies, are much valued by natives, who will freely give £2 2s. a pound for them. There is a third species of rhinoceros (*R. Sumatranus*) from Chittagong, extending southwards into Burmah.

The last but by far the most interesting part of India to the sportsman is Cashmere and the Himalayas. There are two bears distinct from the black bear of the plains found on the Himalayas. The first of these is the brown bear, variously called the red, yellow, grey, silver and snow bear. The scientific name is *Ursus isabellinus*. It is the largest of the bears of the East. It is found in the north-west Himalayas and the mountains round Cashmere. In summer they are found at great elevations close to the snow. In autumn they come down into the forests to feed on the various fruits and acorns, often coming close to villages to plunder the apples, walnuts, apricots, &c. In winter they retreat to caves, remaining in a state of semi-torpidity until March and April. The second bear is the Himalayan Black Bear (*Ursus tibetanus*) which is found in Assam also. In summer it is found at from 9,000 to 12,000 feet of elevation. In winter it descends to 5,000 feet. In the spring it feeds on the wild cherry, yellow wild raspberry, and on the apricot, which it climbs the trees for, as also for walnuts. This bear has bad eyesight but great power of smell, so that it must be carefully approached to leeward. Their black colour makes them very conspicuous. In some years these bears are very plentiful, and in others scarcely any are to be found. If met with suddenly, this bear, as indeed is the case with many animals, will at once attack a man, and in every case mauling the scalp and face. There are few villages in the interior where individuals thus mutilated are not to be found. Of the *Cervidæ*, besides the *Sambur* or *Geron* which has already been mentioned, there is the Cashmere Stag (*Barasingha*), or 12-tined deer (*Cervus Wallichii*) a magnificent deer nearly allied to the red deer of Scotland, which is found within our limits only in Cashmere. It is found in the pine forests ascending up to 12,000 feet in summer, but in winter coming much lower. Unfortunately, most of the stags have shed their horns before the time (15th April) Europeans are allowed to enter the country.

The horns are perfect in October, which is the rutting season, and they may then be easily stalked. The horns of this species sometimes reach as much as four feet in length along the beam, and form a handsome trophy.

In passing, the Thibet Stag (*Cervus affinis*) may be mentioned; it inhabits Eastern Thibet, but how far west it extends we do not know.

The Musk Deer is common throughout the whole of the Himalayan range at high elevations. It is small and hornless, and the male has canine teeth in the upper jaw. The musk is contained in a præputial bag. The female is quite free from all flavour of musk, and is good eating.

Of all the animals of the chase in Cashmere none are more eagerly sought after than the Ibex (*Capra Sibirica*). The horns of the male are magnificent, a pair as long as 4 feet 6 inches being recorded. It is found on the Himalayas from Cashmere to Nepaul, but is numerous in the Burdwan ranges east of Cashmere, and abundant in parts of Kunawar and on some of the ranges on both sides of the Sutlej. In Cashmere the etiquette is that the party first in possession of a valley is allowed to hold it and its surrounding mountains; the next party coming will either pass through the district without disturbing it, or make a détour and proceed to more distant hunting grounds. There is accordingly a great rush when the country is opened, and many dodges resorted to, and many rupees expended, to get first to the ground.

Of other Himalayan animals worthy of the sportsman's rifle the noblest is the Ovis Ammon, but it is only to be found outside our limit, and beyond the snowy range in Thibet. It is the ambition of every sportsman to bag one of these splendid sheep, the horns of which are curved, measure as much as 3 feet 4 inches along the curve, and are 17 inches in circumference at the base. They take a good deal of killing, but the stalking is not so difficult as that of the Gooral or Himalayan Chamois (*Nemorhædeus goral*). This animal is found on the whole Himalayan range, from Bhotan to Cashmere, from 3,000 to 8,000 feet of elevation. It inhabits grassy slopes and stony ridges, and grazes morning and evening, often under pine-trees, generally two or three together, sometimes as many as five or six. On a warm day they frequently lie on some flat rock under the shade of an oak-tree

and are then difficult to make out. The horns are small, and seldom more than 9 inches in length. When startled, they give a sort of half-hiss, half-whistle of alarm, and when bounding away, a shot may often be obtained if the sportsman gives a shrill whistle. The gooral will then almost always pull up, and give the sportsman a good chance.

The Surrow or Forest Goat is another goat found from Cashmere to Sikim, and has even been shot in Burmah. It inhabits precipitous wooded mountains, is solitary in its habits, and awkward in its gait; it is very bold, and has been known to keep the wild dog at bay, and even to kill three or four of them. Colonel Markham relates a narrow escape a friend of his had from being ripped by the sharp horns of one of this species. The height at the shoulder is about 3 feet 2 inches; horns about 10 inches long; and weight about 200 lbs.

The pursuit of the Thar or Teher (*Hemitragus jemlaicus*) the Himalayan wild goat, is said to be the most dangerous of Himalayan sports. It is found in the central ranges of those vast mountains from 7,000 to 13,000 feet elevation, and inhabits the steep sides of precipices and inaccessible mountains. The males are often found much higher, and away from the herd, indeed they seem to desert the herd altogether for a portion of the year. As many as twenty-seven males have been counted together. They feed in the mornings and evenings, and during the day lie up in caves or overhanging rocks. The hair of the neck often falls below the knees, and gives the animal a curious appearance. The horns of this animal are only about 12 inches long; they touch at the base, and are very thick. The female has no mane, and the horns are much smaller. The thar is nearly allied to the Neilgherry Ibex (*Capra hylocria*), but the latter animal has no mane, and the horns run up to 17 inches in length. The best months to shoot thar are October and November.

The Markhor (*Capra megaceros*) is found on the Pir Panjal range ot the Himalayas to the south of the valley of Cashmere, in the Hazara hills, and the hills north of Jhelum, and in the Burdwan hills. It is found on all the hills west of the Indus, the Sulimani range as far south as the junction of the Sutlej with the Indus, and extending north into Afghanistan. The markhor associates in small herds, frequenting steep and rocky hills above the forest region in the

summer, but in winter descending to the bare spots in the wooded regions.

The horns of this magnificent goat are recorded as being 52 inches long, and not uncommonly 48 inches. There appear to be two varieties, as those from the hills west of the Indus have the horns rounder, straighter, and with a uniform twist when compared with those found elsewhere.

The last two in our list of Himalayan animals are the Burhel, or blue wild sheep, and the Ovis Vignei, one of the *Oorials*. The burhel (*Ovis nahura*) is found on the highest range of the Himalayas from Sikhim to near Simla. It is found feeding on the rich grassy slopes close to and watered by the snow. It is the most shy and cunning of all animals except perhaps the markhor and ibex. They associate in large herds of from 10 to 70 or 80. The horns are two feet and upwards along the curve, and the animal is well worth shooting. The best time to shoot them is from August to September, as the skins are then in fine condition. The *Ovis vignei* is one of the oorials, of which there are no less than four races or varieties, viz., *O. vignei*, of Thibet and Ladak, *O. cycloceros*, or Punjab wild sheep, *O. Jerdoni* and *O. Sclateri*.

The oorial is found over the whole salt range of the Punjab on the Sulimani range across the Indus, the hills of the Hazára, and those in the vicinity of Peshawar. They are wary and shy, but not difficult to stalk.

For shooting on the Himalayas a good battery may be said to be carried if a man has two ·450 or ·500 Express double rifles and a strong No. 12 central-fire smooth-bore to take ball or shot.

Of the Indian antelopes the Black Buck (*Antilope bezoartica*) has already been referred to. It is found throughout India in suitable localities. It is rare in Bengal, a few only extending to Purneah and Dinagepore, north of the Ganges, and it is not found on the Malabar coast. It is abundant in the Deccan, in parts of the Doab, between the Jumna and Ganges; also in Hurriana, Rajpootana, and neighbouring districts. The largest herds, consisting of some thousands, have been seen near Jalna, in the Deccan. The horns run to 26 and even 27 inches long. The Nilgai, or Blue Cow (*Portax pictus*), is a bush antelope, found from

near the foot of the Himalayas to Mysore, but is rare to the north of the Ganges and also in the extreme south of India. It is most abundant in Central India and in the country between the Jumna and the Sutlej, but is rare in the Punjaub. It frequents thin forests and low jungles, and is found in small herds of from seven to twenty. It is not much sought after by Indian sportsmen, but affords good sport with the spear, as it requires a good horse to overtake one, and it must be pressed to the utmost at first, or there is little chance of coming up with it.

There are two other antelopes in India which deserve notice. The first is the Indian Gazelle (*Gazella Bennettii*), the horns of which run to about 14 inches in length. It is found most abundantly in the desert parts of Rajpootana, Hurriana, and Sindh. It is never found in forest country, but is often met with in low, thorny jungle. As a rule, however, it prefers the open bare plains or low rocky hills or sand hills. It is generally in small herds of six or seven, and as it is only 26 inches high at the shoulder, requires straight shooting to bag. Both sexes have horns.

The last of the Indian antelopes is the Four-horned Antelope (*Tetraceros quadricornis*). It is found at the foot of the Himalayas, rarely in the Punjaub or Sindh, but abundantly in the hills of the Eastern Ghâts, north of Madras, and extends thence into Central India. It is not found in Malabar. This antelope does not frequent open plains, but may be found in open glades in the forest and in bushy ground skirting thick jungle. It is always found singly or in pairs. The anterior horns are sometimes as much as $1\frac{3}{4}$ inches long; the posterior horns running up to $4\frac{1}{2}$ or 5 inches. In the South of India the anterior horns are frequently wanting, being merely a knob indicating where they should be. The female is hornless.

BRITISH BURMAH.

The only trustworthy book on sport in British Burmah is that by Col. Pollok. It is only of recent years it has been found out by Europeans that sport is to be had in Burmah, and although the author above referred to shows that game was and is to be had, there is even now, owing to various causes—the thickness of the jungles, the absence of shikarees, and the difficulties of carriage—the greatest difficulty in obtaining

good sport. To be successful, it is necessary to use elephants, and elephants are difficult to be procured. But the game is there, and if a man can overcome the obstacles enumerated above he may enjoy splendid sport. It is only fair to Col. Pollok to say that the information given here is mainly taken from his book.

The best places for big game in Burmah are the Arrakan range, Mendoon, near the Maee pass, fifty miles west of Thayetmeu, Eeingmah, Zeagoung, Pounday, along the base of the Yomahs, north of Pegu, Negrais, Bassein, north-west of Tengho, along the Pabay Creek, down the Sittang from Banloung inland towards the Yomahs, Mong, on the opposite bank of the same river, throughout the Yonzaleen; also along the banks of the Attaran river, and in the districts of Mergui and Tavoy. The elephant, which is the same as that found in India, wanders about during the rains, at which time it is useless going out after them, as the nature of the ground is such that no one can traverse the lower lands on account of inundation and the innumerable leeches which, in spite of all precautions, make their way to all parts of the body, and not only drain the blood, but the sores afterwards cause intense and painful irritation. The shots at an elephant are (1) the front shot, in the centre of the lump three inches above the eyes. If the sportsman be on higher ground than the elephant, he must fire above the spot already indicated. (2) The side shot is when the elephant is broadside on to the sportsman, and should be directed to the hole in the ear, or anywhere within a space which is thus obtained: join the top and butt of the ear by an imaginary vertical line, and from each end of this line draw lines to the eye; in the triangle thus formed about one-third of the area from the base is fatal. (3) The temple shot is between the corner of the eye and the top of the ear, when the animal is three-quarters right or left face to the sportsman. (4) Behind the ear, as the elephant is going away. This is a shot not to be depended on. There are three species of rhinoceros in Burmah: the large single-horned rhinoceros, the smaller rhinoceros, and the double-horned. These have been referred to previously in this paper. The buffalo is found throughout Burmah. There are two well-marked varieties: the one with horns long and nearly straight is called *Macrocercus;* the other, with horns shorter, well curved, and more directed upwards, *Spirocercus.* The horns of the female are generally the longer and hand-

somer. A single horn in the British Museum is six feet six inches long, so it may be imagined that the heads form splendid trophies. There is no animal more difficult to kill than the buffalo, and for elephant and buffalo shooting heavy eight-bore rifles, with bullets hardened with one-tenth quicksilver, that is, a bullet-mould full of it to nine leaden bullets, will be found to give admirable results.

The Bison is found in Burmah, and is said to be a finer animal than the Indian variety already referred to.

The Gayel (*Bos frontalis*) is not found in Burmah proper, but is plentiful in the Chittagong hills, and extends into the interior to Munipoor.

The Banteng, or Burmese Wild Cow, is plentiful in Burmah, and extends from the Tenasserim provinces into Malayala, and to Java, Sumatra and Borneo. They are deep red, with white rings round the eyes. The bulls are very handsome, and run to sixteen hands and upwards. There are two bears in Burmah, the *Ursus Malayanus* and the *U. euryspilus*, the latter being the Sun Bear of Borneo. They are both small animals. The bear of the plains of India (*Melursus labiatus*), is not found in Burmah, but extends to Assam. The tiger and panther are both found in Burmah, and the former very often takes to man-eating.

The Tapir is found to the south of the Tenasserim provinces, and although seldom met with on the plains, is not uncommon in the highlands of Mergui and Tavoy.

Of the *Cervidæ* there is first the Sambur (*Rusa aristotelis*). Two varieties of this deer appear to be found, one on the hills, which is identical with the sambur of India, and has magnificent horns, and the other on the plains, which has no mane, and the horns of which are not worth keeping. The next is the brow-antlered deer (*Cervus frontalis*); it is the *Thamine* of Burmah, and is said to be a variety of the Munipoor deer. The antlers are very handsome, having frequently as many as twelve points. They are gregarious, and inhabit open spaces surrounded by tree jungle; they are very fond of marshy spots, feeding on aquatic plants, and are wary and difficult to approach. The best plan of shooting them is to dismount from your elephant near the edge of the tree jungle, and explore the open space on foot. They are plentiful at the foot of the Yomahs, both on the Irrawaddy and Sittang rivers. They are not found amongst the hills.

Hog-deer (*Cervus porcinus*) abound everywhere. They have already been described when treating of the *Cervidæ* of India.

The Barking Deer (*Cervulus aureus*) is only found in hilly places.

The Mouse Deer (*Memimna Indica*) is about the size of a hare, and is found in Tavoy and Mergui, and further south is very plentiful.

There are no antelopes in Burmah.

The Serow (*Nemorhœdus bubulina*) is a forest antelope, and is found in the higher ranges of Arrakan, Pegu and Tenasserim. It has already been described.

The Wild Boar (*Sus Indicus*) is found in great abundance in Burmah, but owing to the nature of the country cannot be ridden and speared.

To the ornithologist India and Burmah offers an unlimited field for observation, and the naturalist may there study the habits and collect the skins of birds almost unknown in England. Of the raptores there are, as may naturally be supposed, an immense variety, from the King Vulture (*Otogyps calvas*) down to the white-naped Pigmy Falcon (*Hierax eutolmos*). The swallows and swifts are also well represented, from the common swallow of Europe to the magnificent spine-tailed swifts measuring as much as twenty inches across the wings, and again the small Palm Swift (*Cypselus battasiensis*) and martins of every variety.

The *Caprimulgidæ*, or goat-suckers, are in great numbers, and not less than eight species are recorded.

There are two species of trogons and a great variety of bee-eaters; of what are popularly known as jays, but which are really rollers, there are four species, all of which have most brilliant plumage. The kingfishers are in great variety and of large size, some being as much as sixteen inches in length. The skins are exported to China and Burmah. In the latter country the feathers are used for court dresses. The great Hornbill (*Homraius bicornis*), commonly called the toucan, is found in the forests and hills of Malabar, as well as on the Himalayas. There are no parrots properly so called, but there are a great variety of parrakeets, some of them very beautiful. Of woodpeckers there are at least thirty different species. The cuckoos are well represented, by birds of all colours and sizes, down to the koel that makes life a burden by its note. The sun-birds, popularly known as humming-birds, are in great variety, and have wonderfully beautiful metallic plumage.

Shrikes, king-crows, fly-catchers, and ground-thrushes are in great numbers and variety, as also tits, orioles, wagtails, and larks. The pigeon family are also well represented, from the imperial pigeon down to the beautiful bronze-winged dove. Then we have the sand-grouse, of which there are four species. Of pheasants there is the monaul, found on the Himalayas, unrivalled for its beautiful metallic green and purple plumage; the Sikim horned pheasant, the under parts of which are crimson-red, with white spots edged with black; the Simla horned pheasant, also a very handsome bird; the green blood-pheasant found on the mountain ranges of Eastern Nepaul and Sikim; the Pakras pheasant in the North-west Himalayas; the Cheer pheasant found in the same locality; the white-crested Kalij pheasant, and the Sikim Kalij, between which hybrids are not unfrequently found. There are two species of jungle fowl found in India (*Gallus ferrugineus*) from the Himalayas southwards, on the west of India as far as the Vindhian Hills, and on the east to the banks of the Godavery River. The second species (*Gallus sonneratii*) is a much handsomer species, and is found from the Godavery to the extreme south. The cocks have very handsome hackles, which are much prized for salmon flies and for ladies' hats.

There are two species of spur fowl, the common and painted. They are considerably smaller than jungle fowl, and difficult to flush, as they are inveterate runners. There are a great variety of partridges, from the Himalayan snow-cock down to the common partridge, which latter bird is found all over the country and close to villages. The flesh of the latter bird is hard and dry, and they are dirty feeders.

The common European quail is found in considerable numbers during the cold season all over the country; fifty couple could easily be bagged by a tolerable shot in one day. It is more numerous in the west and north-west than in the south. Of bush quail there are several species. That grand bird the bustard is found throughout a considerable part of India, most abundant in Rajpootana in the Deccan, and in the Southern Mahratta country. These birds afford great sport; the best weapon for shooting them is a miniature Express rifle. Sometimes they squat in a tuft of grass, and may then be knocked over with a charge of No. 6 shot.

The Houbara bustard is a much smaller bird. It is found throughout the plains of the Punjaub, Upper Sindh and Afghanistan. Capital sport

is to be had with these birds, which may be killed with No. 6 shot, as also with hawks.

The Florikan, of which there are two kinds—the Bengal and the lesser Florikan—afford good sport, and are the best birds in India for the table. The Bengal bird is found throughout Lower Bengal north of the Ganges, extending to the south bank above the junction of the Jumna, and thence through the valley of the Jumna into Rajpootana and parts of the Punjaub. The Churs of the Brahmapootra abound with Florikan, which extend to Assam. The lesser Florikan is abundant in Central and Western India during the rains, and in Southern India from October to March. There are three species of cranes in India—the sarus, the common crane, and the demoiselle crane. The latter assemble in immense flocks in the cold weather over a considerable portion of India, not extending, however, to Lower Bengal nor to the Malabar coast. They are excellent eating and afford good sport in stalking. The *Scolopacinæ* are well represented in India. The largest of the sub-family, the woodcock, is found in the Himalayas, but is difficult to procure owing to the extent of the woods and the steepness of the ground. It is also found from the 1st November to 1st March, or even later, on the Neilgherry, Pulney, Anemully and Shevaroy Hills in Southern India. On these hills the woods are well defined, and can be beaten by dogs and men, and a fair bag of sometimes as many as seven or eight couple made. There are two solitary snipe—the Wood Snipe (*Gallinago nemoricola*) and the Himalayan Solitary Snipe (*Gallinago solitaria*), but they are not found in sufficient numbers to make them worth going after. There are two species of snipe found in India—the Pin-tailed (*Gallinago stenura*) and the Common Snipe (*G. scolopacinus*). The former are the snipe of Southern and the latter of Northern India. They are so like as to be seldom discriminated by the sportsman. They are found in immense numbers all over the country from October to March. The jack snipe and the painted snipe are also to be met with. There are any number of *Tringinæ*, including a great variety of Sandpipers, which rise in such numbers as to be a nuisance to the snipe shooter. Storks, herons and egrets of various sorts are found all over India. Of geese and ducks there are probably a greater variety than in any other part of the world. The common wild goose is found in the North of India, extending to the Central Provinces in the cold weather. The pink-footed goose is

found in the Punjaub and Western India. The dwarf goose is found in Oudh. The bar-headed goose is in great numbers during the cold weather in Bundelcund and the country between Agra and Gwalior. The black-backed goose is common in Central and Western India, and the white-bodied goose-teal is found over the whole of India, Ceylon, Burmah and Malayana. There are two varieties of whistling teal which are permanent residents in India, and two varieties of common teal, which are cold weather visitors. Of ducks there is the shelldrake, the shoveller, the common wild-duck (rare), the spotted-billed duck, a permanent resident, the pink-headed duck, common in Bengal, the gadwall, the pin-tail duck, the widgeon, the red-crested pochard, the white-eyed duck, common in Northern and Central India, and the tufted duck, common in Central and Southern India. The merganser in the Himalayan rivers, and the smew, which is rare except near Delhi. Gulls, grebes, terns, and pelicans are found in great numbers.

The very important question arises in a country which abounds in large and small game—What weapons should a man have?

This may be and is answered in various ways. We will in the first instance take the case of a man who can only afford to have a gun and a rifle. The best thing he can do is to invest in a tolerably heavy 12-bore central-fire wedge-fast hammerless gun to take ball and shot, and weighing from 8 to 9½ lbs. With this he can kill any animal in the jungle up to 40 yards, but of course it is a most unwieldy weapon for snipe shooting. The rifle should be an Express, either a magnum of ·577 or a ·500-bore. The latter will probably be found the best all-round weapon. If, however, money is no object, a very different equipment is recommended, and the following for all-round shooting ought to be taken :—First, a double 8-bored wedge-fast central-fire rifle, 24-inch, barrel, to take 10 drs. of powder, and a spherical hardened ball. The rifle should weigh not less than 17 lbs., and will be found perfect for elephants, rhinoceri, buffaloes, and bison. Secondly, an 8-bore double gun to take the same bullet and cartridge as the rifle, and about 16 lbs. weight, fitted with Silver's recoil plate. The principle should be the same as that on which the rifle is built, and to insure accuracy both rifle and gun should be made at the same time. The barrels must not be less than 31½ inches, and it should be handy enough to shoot duck on the wing, as well as account for a considerable number

out of the flocks which abound on the banks, but which keep just out of shot of a 12-bore.

A ·450 Express rifle, not too light, say $8\frac{3}{4}$ lbs., should be the sportsman's own weapon, and never out of his hand. If the sportsman is a collector or naturalist, an extra pair of barrels of the same bore, but regulated for shot, will secure many specimens of birds which a larger gun would spoil. A 16- or 20-bore gun for snipe shooting would complete the absolute necessary battery to make the equipment perfect. All weapons beyond these are luxuries, but a miniature Express is a wonderful weapon for keeping the hand in, and for shooting antelope or bustard. A man who is not strong enough to use such heavy weapons as above described might have a double 12 rifle and a gun to match, both made to take heavy charges 5 to 6 drs., and in case of special shooting only being gone in for, such as that found in the Himalayas, two double ·500 Express rifles and a rough, strong 12 smooth-bore are amply sufficient. In jungle, animals are shot at very short distances—say, an average of certainly not more than 25 or 30 yards. On the hills, shots will often have to be taken at 150 or even 200 yards, but the former may be considered fair sporting range. The sportsman must be on his guard when shooting on the hills in India not to underrate the distances, as the clear atmosphere is very likely to deceive him. In the Himalayas this is particularly the case.

AFRICA.

There can be no doubt that, owing to firearms being now easily obtainable all over the world, large game is everywhere decreasing. A few years ago only guns were unknown in Central Africa, and readers may recall Captain Speke's account of the surprise and pleasure of the King of Uganda at the performance of Captain Speke with the rifle. Now, however, the king's army, or a considerable portion of it, are armed with muskets which no doubt during peace are used with effect against the *feræ naturæ*. Nevertheless, there is no country in the world which affords such sport as Africa, although the risks that the sportsman has to incur are considerable, and the expense of a well-fitted out expedition heavy.

Should a hunter be successful, his trophies will go a long way towards

paying his expenses, and if trading on a small scale be added to it, a man must be unlucky who is much out of pocket.

In Africa is found the elephant, both sexes of which have tusks; the rhinoceros, of which there are five species: the giraffe, the hippopotamus, the lion, the panther, the hunting cheetah. There are few representatives of the Cervidæ, but to make up for this there is an almost infinite variety of the Antilopinæ. There is also the quagga and two species of zebra; two species of buffalo and the wart hog, or masked wild boar.

The elephant is, *par excellence*, the animal with which Africa is associated in the minds of the sportsman, naturalist, and philanthropist. To the sportsman it is an animal from which the grandest and most valued trophies are obtained; to the naturalist it is interesting as having been originally domesticated by the Carthaginians, since which period, until quite recently, it was unknown in Europe. Again, if the present slaughter continues, its extinction cannot be far distant. England alone imports annually 1,200,000 lbs. of ivory, in order to obtain which the lives of probably 30,000 elephants are sacrificed.

To give one instance only, we have information on the best authority of 105 elephants having been driven into a swamp, and 103 being killed, the slaughter continuing for eleven hours! Such butchery is absolutely sickening.

The philanthropist is interested in the elephant because it is to carry the tusks that the whole of Central Africa is demoralised, and its inhabitants seized as slaves and used as beasts of burden. It is the Government of Egypt that is to blame for this, and, notwithstanding their promises to our Government and the appointment of Sir Samuel Baker in the first instance, and "Chinese" Gordon afterwards, to whom nominal powers were given to abolish slavery, the traders and "backscheesh" have carried the day, and slavery flourishes as of old. Owing to the unremitting persecution to which the elephant is subjected, it is forced farther and farther back. It is found in the Transvaal, but is there so shy that it is necessary to hunt it on horseback; the general way adopted being to break a fore-foot, which disables it, and then it is shot at until it dies. As many as possible of a troop are thus disabled, and finished off at leisure. Elephants are also found in Abyssinia, and high up on the Nile. It may be assumed that the African elephant cannot, except by chance, be killed by what is known as

the front shot in the head. Sir S. Baker relates how he fired three No. 10 hardened bullets with 7 drs. of powder in a space of 3 inches at a female without appreciable effect. The side and temple shots, however, are as deadly to the African as to the Indian elephant.

The rifles or guns for elephants should be 8- or 10-bores with hardened bullets, that is, to kill them off in a sportsmanlike manner, but the Boers shoot them as above described with Martini-Henry or Express rifles of the same bore. The African elephant differs much in his habits from the Indian. The former enjoys the burning sun in the hottest hours of the day on plains of withered grass miles away from jungle, whilst the Indian elephant is impatient of the sun, and loves shade. The tusks of the Abyssinian elephant seldom exceed 40 lbs. each, and are short and thick. Those of Central Africa are much finer and longer, and a single tusk weighs 150 lbs. or more. The African elephant is on an average one foot higher than the Indian animal; they are killed in pitfalls; by men on horseback, either with swords or spears: by men posted in trees with spears having blades 8 inches long and 3 inches wide. The perfection of sport is hunting the elephant on horseback, which is practised by the Hamran Arabs on the west of Abyssinia. One man rides close up to an elephant and induces him to charge, keeping just out of his reach; his two companions, armed with swords 3 feet long and 1 in. wide, meanwhile ride after, and when close to the elephant, and whilst at speed, one springs off his horse and with a two-handed blow severs the back sinew. The hunter immediately re-mounts. If the blow be successful, the elephant becomes disabled by the first pressure of his foot on the ground. The hunter who has been leading now turns, and, riding to within a few feet of the elephant, induces him to attempt another charge. This affords an opportunity of severing the sinew of the other hind-leg, and the animal is at once brought to a standstill, and dies from loss of blood in a short time. Thus this huge animal is literally killed by two cuts of a sword by the plucky Arabs. It is to be hoped that as Indian elephants have now been introduced into Africa that an attempt may be made to catch and tame the wild ones of that country, as nothing would tend to civilise Africa so much as being able to march through the country and carry merchandise on the backs of animals which are indigenous and not affected by that curse, the tsetse fly, which attacks camels, horses, donkeys, bullocks, and

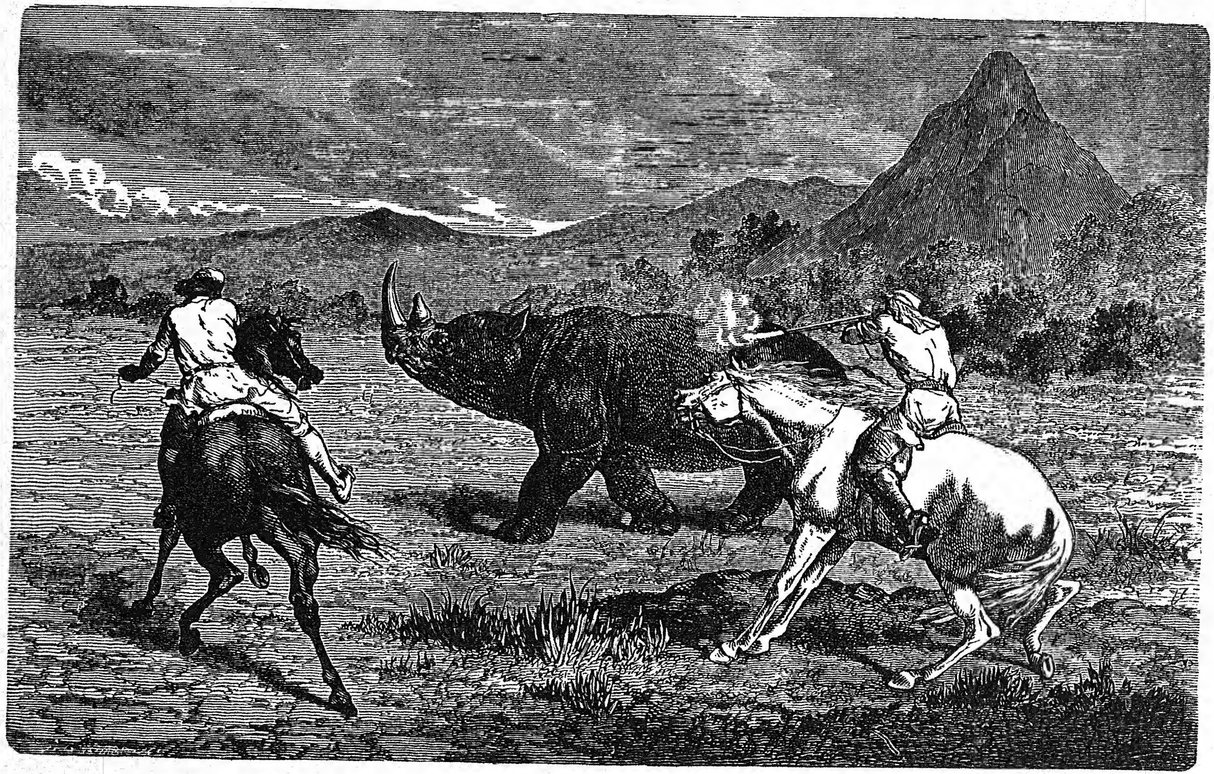
all other domesticated beasts of burden. It is probable that the best way to catch the African elephant would be by driving a herd into a keddah or enclosure surrounded by a trench, which need not be more than 8 feet wide at the top, and have a diameter of 50 to 60 yards. The reason the trench is likely to be the best plan is, that the African elephant is in the habit of overturning trees, and consequently no stockade made of manageable-sized logs could be constructed in which they would be secure. With a dozen Indian elephants any number of African elephants might be secured; without their assistance it would be almost impossible to secure them even when caught in the keddah. Next to the elephant the rhinoceros affords the most exciting shooting in Africa. There are several species—some naturalists say as many as five. The most noticeable are *Rhinoceros Africanus*, *Rhinoceros Simus*, *Rhinoceros Keitloa*. The *Rhinoceros Africanus*, under the name of Rhinoster, has been known to the Dutch since the year 1652, when they landed at the Cape. In that year this animal was a regular inhabitant of the slopes of Table Mountain, but it is scarcely necessary to add that many a weary mile has now to be traversed before the sportsman comes in sight of the spoor of rhinosceri of any species.

The *Rhinoceros Simus*, or white rhinoceros, is not found farther south than 25½° S. lat. It stands 6 ft. 6 in. or 6 ft. 8 in. in height. In this species the posterior horn is a mere excrescence, 5 or 6 inches in length.

The Black Rhinoceros (*R. Keitloa*) is the most vicious of any of the species. It does not range higher than 25° S. lat. It stands from 5 ft. 6 in. to 5 ft. 8 in. on the shoulder.

The sight of this animal is bad, but the powers of scent so strongly developed that it can wind a man at 500 or 600 yards, and then never fails to charge down. It is almost impossible to kill this animal when charging, as the brain is so well protected by the horns. The hide of this animal will make seven shields, the material for each selling at two dollars each, and the horn is sold at two dollars per lb. for sword-hilts. Almost all the different species of rhinosceri return to deposit their ordure in a heap which is often of considerable size. They may very often be shot by watching near one of these heaps. The shot behind the shoulder is the most deadly one, and a heavy rifle and hardened bullets should be used. Rhinosceri may also be hunted on horseback, and pretty sport be thus obtained.

The hippopotamus is the next animal that claims our attention. This



Rhinoceros Hunting.

huge animal is found throughout the rivers of Africa, although comparatively rare on the borders of a civilised country. In Central Africa they are in such numbers that Mr. F. F. Carter, who is in charge of the Indian elephants of the Belgian expedition, says in one of his letters that he does not count them when recounting the game he has shot. They are almost invariably shot in the head, the point behind the ear being the most deadly. The old bulls are occasionally most ferocious, frequently attacking unprovoked, and crunching up boats into matchwood. Sir Samuel Baker, in his "Ismaila," describes how one of these animals drove its tusks through his zinc dahabeah, and the difficulty he had with the heaviest charges of powder and cast-iron shells in killing it. The hippopotamus is eaten by all the tribes of the interior. The tusks are most valuable for making false teeth, as the ivory never loses its colour, and the hide is used for making coorbatches or camel-whips.

Lions are found throughout Africa, and are not so difficult to kill as the tiger of India. In some parts they are so numerous that the traveller is obliged to construct thorn fences to protect the cattle and horses. Lions are almost entirely nocturnal in their habits, and will nearly always avoid man by daylight if possible, unless when come upon suddenly or wounded. In the latter case they will most assuredly show fight.

Naturalists are agreed that there is but one species of lion including the Indian animal (which from a young specimen was named the maneless lion of Goojerat) and the Babylonian lion. Mr. Parker Gilmore ("Ubique"), says he is certain that there are three species—the black-maned, the yellow-maned, and the maneless lion. There is no doubt that there are varieties of the lion as there are of the tiger and elephant, but they are all of one species.

There are two other of the Felidæ found in Africa—the Leopard (*Felis pardus*), and the Hunting Leopard (*Felis jubata*). Both these animals, if not exactly the same, are merely varieties of the same animals found in India. Mr. Parker Gilmore, who seems inclined to lean to a variety of species not recognised by naturalists, says he is convinced that there are three distinct species in Africa—the first thick and massive about the body like a well-fed domestic cat; the next stands taller, has coarse hair, and is imperfect in its markings; and the third he describes as standing high on its legs, possesses a beautiful and regularly-marked skin,

and limbs that are really extraordinary in their size and power, while the tail is shorter than in what he claims to be distinct species.

Mr. Bartlett, the superintendent of the Zoological Gardens, naturally differed from Mr. Gilmore on this point, and it may safely be assumed that there are only two species of large spotted cats in Africa.

The magnificent giraffe has elicited bursts of enthusiasm from even the most matter-of-fact sportsmen. His peculiar shape, great height (18 to 20 feet), and the extreme beauty of the skin, render the giraffe an animal to shoot, which men will go through a great deal, and having shot it invariably regret that they have killed so handsome and harmless an animal. From its enormous height it is almost impossible to stalk a giraffe, although it has been done. The usual way of hunting them is on horseback, and the horse must be ridden at best speed at first in order to blow them, when a shot behind the shoulder from almost any rifle will bring them down. Mr. F. F. Carter, above referred to, killed a couple with a Winchester rifle at long range, but a handy breech-loading Express would probably prove more suitable. The flesh of the giraffe is excellent except at certain seasons, when it becomes highly scented owing to the animal feeding upon a peculiar species of mimosa. The bones of the giraffe are solid, like those of the elephant and hippopotamus, and have no marrow. The long tendons of the legs are much prized by the Arabs instead of thread for sewing leather, and also for guitar strings. The giraffe was formerly found in the Cape Colony. It is probably not now found south of the Tropic of Capricorn.

There are two, if not three, species of buffalo in Africa (*Bubalus Caffir*), the common buffalo of the country, which differs from that of India in the shape of the head and horns; the latter almost meet at the base and turn upwards and inwards at the tips, which are sometimes as much as five feet apart. The second species is *B. æquinoctialis*, and is found in Eastern Africa. Buffaloes are usually found in large herds, as many as 500 or 600 having been seen together. They are a most difficult animal to kill, and heavier rifles and guns are necessary in following them than almost any other animal. Solitary bulls will frequently charge without provocation, but if the sportsman waits coolly, they can nearly always be killed at close quarters before they can make good their charge.

There are four species of Equidæ in Africa, viz., *Asinus zebra*, *Equus*

quagga, Equus Burchellii, and a true ass shot by Sir Samuel Baker on the banks of the Atbara, one of the Nile tributaries of Abyssinia.

The zebra is exclusively confined to mountainous regions, from which it rarely descends, and differs from the quagga and Burchell's zebra by having the tail and ears of an ass, whilst the other two have the ears and tail of a horse. The Quagga and the Gnoo (an equine antelope) delighting in the same sort of country, are frequently found together, and Burchell's zebra is generally accompanied by the brindled gnoo, an entirely different animal.

The Cervidæ proper are poorly represented in Africa, the Barbary stag, something like our red-deer, being the principal representative; but the absence of deer is more than compensated for by the great number and varieties of antelope of which Africa is the head-quarters.

The first of the Equine antelopes is the Gnoo (*Catoblepas gnoo*), the "Wilde-beste" of the Cape Colonists. It is a most curious-looking animal. The horns are broad, approximated at the base, taper sideways over the eyes, and sweep downwards and upwards with a regular curve, and give the animal a sinister and suspicious aspect. Above the muzzle is situated a conspicuous tuft of black bristling hairs, radiating laterally and resembling a blacking-brush. The neck is furnished with a full vertical mane of wiry white hairs. The belly has a bush of full black hair, longest between the forelegs. The tail is equine, white, and reaches the ground. At a distance these animals are often mistaken for quaggas. The male is four feet high at the shoulder; they are gregarious, and used to be found in large herds on the plains of the Vaal river. The Brindled Gnoo (*Catoblepas gorgon*) stands even higher at the shoulder. The horns are black, placed horizontally on the head, the points turned upwards and then acutely inwards; a long, flowing black mane on the neck extending beyond the withers; chin covered with a copious black beard, descending down the dewlap to the breast; tail black, flowing, and reaching to the heels; gregarious; is found on plains beyond the Orange river. The Koodoo (*Strepsiceros koodo*) has been thus described :—Majestic in its carriage and brilliant in its colour this species may with propriety be styled the king of the tribe. Other antelopes are stately, elegant, or curious, but the solitude-seeking koodoo is absolutely regal! The ground colour is a lively French grey, with several transverse white bands passing over the back

and loins; a copious mane, and deeply-fringed tri-coloured dewlap, setting off a ponderous pair of horns, symmetrical, spirally twisted, surrounded by a prominent wreath which follows all their windings, and upwards of three feet in length. This animal is found on the banks of the Limpopo river, and also further north.

The Eland (*Boselaphus oreas*) is probably the largest of the antelopes, an adult male standing 6 ft. 6 in. at the shoulder, with horns about two feet long. This animal affords no sport, and is so stupid that the Cape farmers frequently drive it close to their own homes before killing it. Livingstone describes the flesh as being better than the best beef, and an attempt was made to naturalise it in England—a large number bred here having been shown at a cattle show. It was formerly very common in the neighbourhood of Capetown, but it is needless to say that it is now only found far in the interior of the country.

The Hartebeest (*Acronotus caama*) stands about five feet high at the withers, and is one of the most common antelopes in Africa. General colour, bright sienna, with a deep-red cast; the horns are placed high above the frontals, very close at the base, robust, divergent, and again approximating so as to form a lozenge with double flexures strongly pronounced, turned forwards and the points backwards with several prominent knots on the anterior surface. There is a triangular spot of white immediately above on each buttock, and a yellow spot above each eye; the eyes are fiery red. It is found in large herds beyond the Orange river. The Sassaybe is the bastard hartebeest of the Colonists, and is considerably smaller than the animal last described; the general colour is deep blackish, purple-brown above, fulvous below. It inhabits the country of the Bechuanas in considerable numbers. One of the most beautiful of the antelopes of Africa is the Sable Antelope (*Aigocerus niger*), which was first shot by Sir Cornwallis Harris in 1837. The adult male stands 4 ft. 6 in. at the withers; horns, 37 inches along the curve. The general colour of the coat is intense glossy-black, with an occasional cast of deep chestnut; a white streak commencing above each eye, continued by a pencil of long hairs covering the place of the suborbital sinus (of which no trace is to be found), and then running down the side of the nose to the muzzle which is entirely white; belly, buttocks, and inside of the thighs, pure white.

This animal is very rare, and inhabits the great mountain range of the eastern portion of the Matabali country. It is also found on the banks

The Hartebeest (*Acronotus caama*).

of the White Nile. The Maarif is a variety of the sable antelope, and was first discovered and shot by Sir Samuel Baker in Abyssinia. It

stands 14 hands at the shoulder, is mouse-grey with a black stripe across the shoulders, and black-and-white lines across the cheek. It inhabits open plains, upon which it can see an enemy at a great distance, and is a most difficult animal to stalk.

The Roan Antelope (*Aigocerus equina*) is a handsome animal, five feet at the shoulder, with very strong horns two feet long, bent back in the shape of a scimitar. It is found in the elevated ridges near the source of the Vaal and Limpopo rivers. The Water Buck is another beautiful Antelope (*Kobus ellipsiprymnus*) found on the Limpopo, near the Tropic of Capricorn, and also on the banks of all the great lakes in Central Africa as well as in Abyssinia. Although but four feet high the horns run to 30 inches long. The general colour is greyish sepia-brown; the forehead is deep-brown; the under lip and muzzle is white, and there is a white patch on the throat. The Gemsbok, or South African Oryx (*Oryx capensis*), is 3 ft. 10 in. at the shoulder, and has horns three feet long. The general colour of the coat is vinous buff; the breast, belly, and extremities white, with a bushy black tail which sweeps the ground. It is found in the Karroo or in the open plains of Namaqualand. The Springbok (*Gazella euchore*) come down to the Karroo in July in countless numbers; they are treated as vermin and not game. They are about 2 ft. 8 in. at the shoulder, and require a rifle to bag them.

Of other antelopes there are the Blesbok (*Gazella albifrons*) found on the Vaal river; the Pied Antelope (*Gazella pygarga*), the Bonte-bok of the colonists; the Pallah (*Antilope melampus*), which inhabits the thinly-wooded banks of rivers in the Bechuana country; the Bush-bok (*Tragelaptrus sylvatica*), which is solitary and inhabits forests on the sea-coast; the Rhee-bok, two species; the Ourebi of the colonists; the Klipspringer; the Steen-bok (*Tragulus rupestris*); the Grys-bok (*Tragulus melanotis*); the Duiker (*Cephalopus mengens*); and many others which it would be tedious to enumerate.

There is a heavy licence on guns imported into the Cape Colony—£1 on each barrel, which must be stamped. It is also necessary to have a license to shoot, which costs 7s. 6d. per annum. To be successful in shooting large game in Africa, a couple of waggons with spare teams of bullocks are necessary, as everything the sportsman requires has to be carried with him. In addition he must have horses which should be

"salted," that is, must have had the epidemic known as horse-sickness which prevails on the north of the Vaal river, particularly on the banks of the Limpopo. The extent to which this prevails may be judged from the fact that a horse worth £6 in the Free State will fetch from £100 to £120 among the Bechuanas, and £150 in the Matabele country.

The question as to what is the best battery for Africa is, of course, all-important. The Boers, who formerly used long single-barrelled guns called Roers, now go in for various sorts of breech-loaders—a very favourite weapon being one carrying shot or loopers in the right barrel which is of 16- or 12-bore, and rifled for the No. 2 Musket-cartridge in the left. This "No. 2" is ·450 bore, and takes the Henry rifling. The single-barrel Martini, with hardened bullets, is also a favourite weapon with which they shoot anything, from an elephant downwards. Some lean to a ·500 Express, with hardened bullets for the larger animals and hollow shells for the smaller. With the Boers the W.R. Fallingblock is not so much in favour as the Martini-Henry or the Field long-range rifles. Again, men who go in for large game only prefer a single barrel 8-bore weighing but 12 lbs., which for such a bore is manifestly too light.

Looking at the enormous animals, such as the elephant, buffalo, rhinoceros and hippopotamus, which are met with, it would appear that a heavy battery is necessary. A perfect one would be two double 8 rifles two double 8 guns, both rifles and guns taking 10 drs. of powder and the same bullet and cartridge. The Wedge-fast has been found to be the best and most powerful action, and is strongly recommended. If a lighter battery is desired, the guns and rifles might be 10-bore instead of 8. This would be a saving in weight both in the guns themselves as well as in the ammunition. In addition to the above the sportsman should have a light and handy rifle, to be always carried by himself; and a double ·450 Express weighing about 8 lbs. or 8½ lbs. would probably be the best, and be powerful enough with a hardened ball *on occasions* to kill even a rhinoceros. The cartridges should be wrapped in flannel and soldered up in tins of fifty each.

To this battery should be added a strong double 12 breech-loader smooth-bore, the most useful of all weapons whether for ball or shot. There is no use taking beads to Southern Africa, the market has long ago been overstocked, and the savages know the value of almost every article

as well as a Londoner. Their great ambition is to possess a musket and a blanket, and some of these articles should form part of the impedimenta of every traveller. Gaudy-coloured prints, galvanic batteries, wheels of life and toys, are still in request; and, above everything, snuff and tobacco. A good store of shot—No. 6, 10, and A A—will be found necessary. In Central Africa, on the other hand, beads, wire, hatchets, toys and bright coloured calico, are still articles of solid value; and Sir S. Baker mentions that he has known a handsome girl bought for thirteen needles! The traveller's clothes should be made of moleskin; no other material will stand the thorns in a country where nearly every tree is thorny. They should be dyed a neutral tint; but failing that precaution, it may safely be assumed that they will soon become coloured by dirt. Plenty of water-proof calico should be taken; but vulcanised india-rubber fabrics will not stand in Africa.

A couple of large carriage umbrellas, with double lining, rings fixed to the extremity of the ribs, and a spike like that of a fishing-rod to screw into the handle, will form an excellent protection from sun or rain during the march. A quart syringe for injecting brine into fresh meat is recommended by Sir S. Baker. Burning-glasses and flint and steels are the best means of making fire, as matches become useless in wet weather, and in dry weather may set fire to your baggage.

All boxes for rough travelling should be made of strong metal japanned. When riding the best way of carrying the gun is that adopted by the Boers: a leather bag, fitting the stock of the gun loosely and coming up so as to cover the hammers, is secured to the D of the saddle in front of the rider's right leg; the bottom of the bag is fastened to the girth by a strap; the gun is slipped into the bag rib upwards, and the barrel lies under the right arm of the rider. It is thus easy to pull out the gun when required, as there are no straps or fastenings to undo; and even when the rider is dismounted the gun lies in a perfectly safe position.

Full particulars of this method of carrying a gun on horseback will be found in that most useful book—Galton's "Art of Travel."

Of the birds the most valuable is the ostrich, the feathers of a single male bird being worth £40. It is now necessary to go very far afield to get them. Once in about three years rain falls in the Kalahari desert,

and when this occurs a sort of melon springs up which the ostriches come to eat. This melon, when crushed, yields the only water to be had either for man or beast. Ostriches always run up wind, and the hunter should be concealed whilst his companions drive the birds towards him. An Express rifle is the weapon to shoot them with. The bustard family are well represented in Africa. The Paauw (*Otis kori*) is the largest, weighing as much as 50 lbs. It should be here explained that nearly all the bustards in South Africa are called by this name, which means peacock in Dutch. *O. cærulescens* is another bustard found in Kaffraria; it is only about 17½ inches in height. *O. Denhami* is much larger, being nearly 4 feet in height. *Houbara undulata* is found in Northern Africa.

The Common Crane (*Grus cinerea*) is found in Africa, as also the Demoiselle Crane (*Anthropoides virgo*). This latter bird is excellent for the table. In North Africa is found one Crowned Crane (*Anthropoides pavonius*); and in Southern Africa a second (*Grus regulorum*). The Secretary-bird (*Gyporgeranus serpentarius*) must not be omitted. Its name is derived from the long ear-coverts, which resemble the pens which Dutch clerks stick behind their ears when interrupted in writing. It lives on snakes and reptiles, and is protected by custom, if not by law, on account of its usefulness. There are several species of Guinea-fowl in Africa—the common bird (*Numida meleagris*). The crested Guinea-fowl (*N. cristata*) is found in the great Namaqua country; and a third species (*N. maculipennis*). It would be an endless task to enumerate the various genera of birds interesting to a collector to be found in Africa. One or two curious forms need only be indicated, one a Goat-sucker (*Caprimulgus*) discovered by Captain Speke in Central Africa, the wing-coverts of which float a long way beyond the tail; and the Widdah birds, with tails so long as to appear entirely disproportionate to the body. The crocodile should not be forgotten. All the large rivers and lakes in Central Africa swarm with them, and great loss of human life, as well as of cattle, is due to these saurians. The two deadly shots are either through the brain or neck.

On the western coast at Sierra Leone, Francolin (a sort of partridge) are found. Their favourite resorts are round Signal Hill or up the river at Kirs, as also on the Bullum shore, where bustard are also found. On the Gold Coast small game is plentiful near Wumbak, Secconi River and Nuigua, where deer, snipe, brush-turkey and quail can be had, as also

hares. Good bird-shooting, and with occasional gazelle and hares, is to be had in Algeria, and the same all along the coast of Mogador. The wild-fowl are numerous, and of endless variety. Excursions inland may be made for large game—lions, leopards, &c.—but they are often expensive trips, and must often be of a few weeks to be successful. Round Tangiers there is good bird-shooting, and all along the coast-line blue-rock pigeons are met with. Such varied coast shooting continues as far south as Senegambia, and will pay better than walking over inland marshes or plains, the natives hunting inland regularly for hares, and taking the eggs of game birds.

There is excellent sport on the lands adjacent the Congo, and in a few years this district may develop into a first-rate sporting centre.

Throughout the district the season for shooting is from September to January. Gentlemen visiting South Africa and calling at Capetown will receive information and attention from our agent there, Mr. W. Rawbone, gunmaker. Central Africa may now be said to be open, as a regular track has been cut from Zanzibar to Lake Tanganyika by the Belgian expedition, and splendid large-game shooting is to be had there.

AMERICA—UNITED STATES.

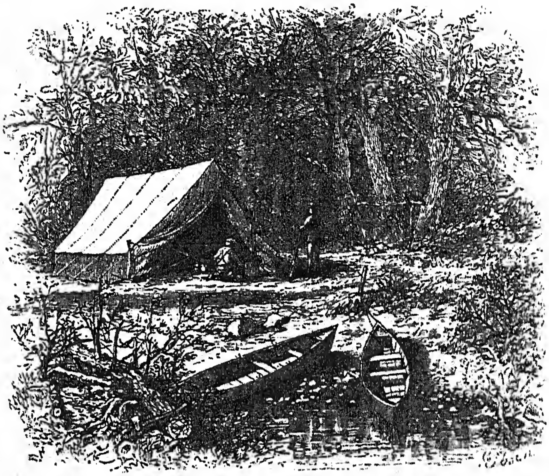
The best method to obtain game is to go by rail or stage to some town in a well-stocked district, and from thence make an excursion into the woods or plains, and camp out amidst the game.

A trip for sport on to the "plains" of the south-west, to be really successful must be made with one or more wagons, and extend over several weeks. Good advice on camp requisites, travel, and camping-out in the plains is given in "Hunting Grounds of the Great West," by Dodge. Smaller parties can, however, get very good sport by taking a boat and drifting down the less frequented streams, or by journeying by wagon or boat to a camping-place, and from thence making daily excursions on foot or by water.

In camping-out, the tent must be pitched on as high ground as possible; if near a stream, the ground must be the highest, to prevent inundation in case of the sudden rising of the water. Never select a camping-place under large trees, as, in case of a storm, they may fall, to

the destruction of the tents and occupants. The tent should, however, be near trees or brushwood, in order to shelter it as much as possible from gales of wind.

As to camp requisites: for four or five persons, a tent covering 9 feet by 12, house-shaped, with perpendicular sides, is the best; a fly-sheet to cover the roof is the best preventative against leaking during heavy or continued rain. The tent may be of sail-duck or good heavy "drilling," and with care either will last two years.



The American Sportsman's Camp.

A cooking-stove is an article necessary to the comfort of the camp. It should be of sheet-iron, and so constructed that the utensils pack within it. A very good one, weighing only 35 lbs., cooking for ten persons, and packing into 12 × 12 × 20 inches, is to be had of Mr. Squires, New York.

Other requisites consist of two large chests—one for ammunition and gun accessories, the other for provisions. Clothes and sundries are best contained in stout waterproof bags.

As to provisions, the number and tastes of the party will rule as to their quality and quantity. Experienced hunters prefer to do without luxuries,

and do not even bother about variety. The following is a list of all that is really necessary :—Flour, beans, corn-meal, baking powder, coffee, sugar, molasses, salt, pepper and pork; a good supply of towels, soap, matches, rag and oil for lanterns, must not be forgotten. For tools—an axe, saw, auger, awl, and the usual requisites of a gun-case, will, with a few nails, be sufficient for most emergencies. Blankets and waterproof sheet will serve for bed-clothing. In cold weather sleeping on ground is the warmest; but if skunks, snakes, or "small vermin" are troublesome, a hammock is the best. Should the camp be pitched for any length of time, a bedstead may be taken, or one built of poles and cords. A pocket-compass is always useful, and essential to most who travel in the woods, on the plains, or tread the swamps.

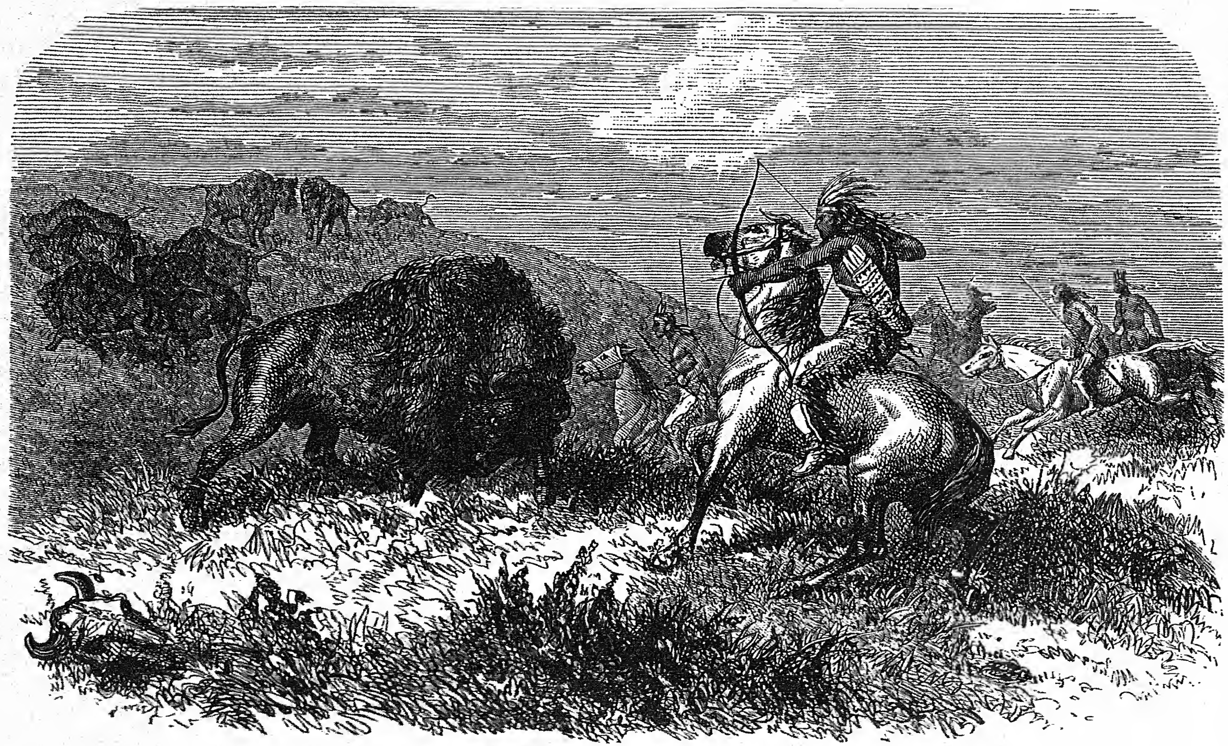
GAME AND GAME RESORTS.

The Buffalo (*Bison Americanus*) is considered the first game of North America. Although rapidly decreasing in numbers, there are still several millions distributed over the United States and Canada. Advices from Montana Territory early in the fall of 1880 stated many parts of the country to be literally alive with Buffalo. Buffalo-hunting as a sport is tame after the excitement of killing the first half-dozen, for no more skill is required to kill 20 or 100 Buffalo than to kill one.

A hunting-party may consist of any number more than two. It is usual to take a wagon and team, travel on to the plains, and camp-out, returning with the spoil when glutted with the sport.

Indians will doubtless be met with on these excursions, as they always stick close to the main herd of Buffalo; but as long as they have success in hunting, and are not in want of food, they seldom interfere with other hunting-parties, beyond an occasional attempt to stampede cattle, which a little care can always guard against. The Indians still hunt the Buffalo with bow and arrows, and consequently get to close quarters. A ball-gun is sometimes used by other hunters, but a rifle is preferable; a brace of saddle-pistols or an army revolver is usually carried in addition.

There are at present two Buffalo ranges in the United States—the southern, extending from 32° to 37°32′ north latitude, and from 99° to 104° west longitude; or, roughly speaking, from the Arkansas River on



Indians Buffalo-hunting on the Llano Estacado.

the north to the Rivers Brazos and Colorado on the south. The western limit is the Rio Pecos; the eastern, the Witchita Mountains in Indian Territory.

This vast tract includes part of Texas, Indian Territory, New Mexico, Kansas and Colorado, and several Indian reservations. This part of the United States is also much infested with white and coloured thieves and outlaws. Only stragglers from the herd are now to be found in Texas; the main herd is supposed to have crossed into Mexico.

The hunting-ground is best made from the north, going by rail to any of the small stations on the South Pacific or Atchison, Topeka, and Santa Fè railroads. The stations of Hays Ellis and Kit Carson are most frequented by sportsmen.

The northern Buffalo range cannot be exactly defined. It extends from the Missouri River on the north and east, to the Rocky Mountains on the west, and the south fork of the Big Cheyenne River on the south.

This tract includes parts of Montana, Wyoming and Dakota, and numerous Indian reservations. At present it is most difficult to reach, but the Northern Pacific Railway will pass through the heart of this fine hunting-ground. The herd in the U. S. territories has been broken up, the main division driven into British territory, and only small detachments exist, and these in the fastnesses of the Rockies.

Most hunting-parties now start from Rawlins on the Union Pacific Railway. Some, however, go from Bismarck, the present terminus of the Northern Pacific Railroad, and travel along the stage road from that city to Helena, Montana, branching off along the Powder River Valley.

The abundance of Buffalo may be judged by the fact that it was estimated that 4,500,000 of Buffalos were killed during the three years 1872—74, and in 1878 over 60,000 Buffalo robes were shipped down the Yellowstone River. In the season of 1880 a professional robe-hunter killed 2,000 head of Buffalo in Montana, and in 1882 some 800,000 are estimated to have been killed in this region, yet in the present year only a few stragglers are to be found, and the northern herd may be said to be extinct.

Many Buffalo are likewise to be found in broken herds between the two Buffalo ranges we have mentioned.

Some thousands inhabit the country between the Arkansas and South Platte, and in 1874 large numbers crossed over to the flats between the North and South Platte.

The deep cañons of the Cimarron Valley also hold a few Buffalo, and are more easily reached than the main herd on the Llano Estacado or Staked Plain.

In the northern range, the valleys of the Yellowstone, Bighorn, Tongue, Powder, Sweetwater and Wind Rivers are the most favoured localities for the Buffalo, as well as Elk, Deer, Antelope, and other "Injun cattle."

A variety of the Buffalo, known as the Rocky Mountain Buffalo, is found in the mountains of that name; it is smaller and shaggier than the plains' Buffalo, and is far more difficult to stalk. It inhabits "the deepest, darkest defiles, or the craggy, almost precipitous sides of mountains, inaccessible to any but the most practised mountaineers." Its size makes it easily distinguishable from the ordinary Buffalo, which, generally speaking, may be found on all the eastern slopes of the Rockies not yet taken into cultivation.

Wild cattle are shot by ranchemen in Texas and Mexico; the sport is more dangerous and exciting than Buffalo-hunting.

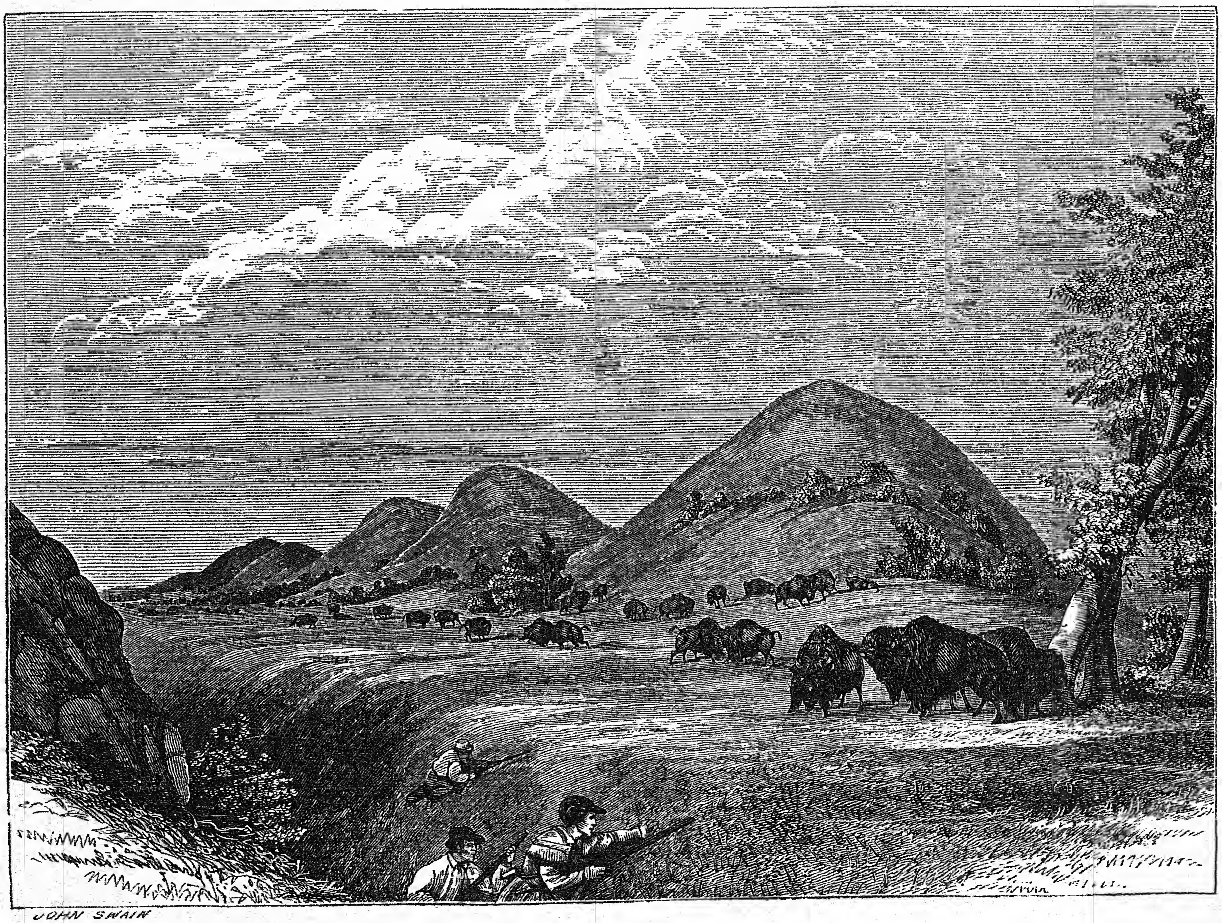
The American Elk (*Cervus strongyloceros*) is found all over North America where civilisation has not exterminated it. Montana, Wyoming, Kansas, and Indian territory are *known* to be simply alive with these animals, and doubtless other territories are stocked in a similar manner.

An excellent country for Elk, Deer, Bear, Antelope, and Mountain Sheep is that near the Bear, Snake, and Upper Cache-la-Poudre Rivers, on the south side of the Union Pacific Railroad. The Upper and Middle Parks in Colorado are also well stocked with all sorts of game.

In all the States westward of the Rockies to the Pacific coast, game may be found in sufficient numbers to satisfy even an inordinate sporting appetite.

In California Deer and Bear constitute the chief varieties of large game, and these, particularly the former, are very plentiful in nearly all parts of the State. Nevada is the worst hunting-ground of any of the western states.

Eastward of the Mississippi the hunting of large game is confined to a few Moose and fewer Panthers, and Black Bears, which are only plentiful



Buffalo Shooting (after *Catlin*).

amongst the cane-brakes of some of the southern states, and the wilds of Northern Maine and Michigan. They are, however, frequently seen in eastern Tennessee, western Pennsylvania, North Carolina and Virginia, and are sometimes seen in even more thickly-settled portions of the country.

Panthers are mostly found in the cane-brakes of the south, Florida, Texas, Louisiana, and in the wilds of the Alleghanies, Cumberland and Blue Ridge Mountains.

The Moose is only found in the northern portions of Maine and Michigan, and British territory.

Other Deer, the Black-tailed (*C. marcrotis*), and the White-tailed or Red Deer (*C. lencurus*), are found throughout the States: Northern Wisconsin, Michigan and New York, western Pennsylvania, West Virginia, Virginia, Tennessee and North Carolina are the best-stocked eastern states. In all the southern and western states there is Deer-shooting galore at districts remote from the settlements.

For Antelope (*Antelope furcifer*) the plains of the southern and western states are best suited. Northern Texas, Kansas, Colorado and Montana abound with Antelope; but the rapid settling up of the country, especially sheep-farming, is making this game far less plentiful.

The Bighorn, or Rocky Mountain Sheep (*Capra Canadensis*), is to be found among the highest peaks of the Rockies and the Black Hills. This animal is considered the finest sporting animal in the United States, its habits being similar to the European Mouflon. Great care and judgment are required to stalk it successfully.

The American Hare or Jack Rabbit (*Lepus Americanus*) is common throughout the eastern as well as the southern and western states. It is similar in habits and size to the common English Hare. A Blue Hare is found in the Rocky Mountain Range. Besides these animals the hunter on the plains may meet with the Cougar, Puma, or Mexican Lion, which, if he is a good, unerring shot, he may attack. If at all nervous, the hunter had better leave the animal alone, as it is one of the strongest and most dangerous of the carnivora. They are great destroyers of game, and, like Wolves, Coyotes, Foxes, Otters, Skunks, Lynxes, Wolverines, Panthers and Bears, should never be spared upon a favourable opportunity offering itself.

For Bear-hunting, dogs are a valuable acquisition, and without them

a hunter may often travel the woods for weeks without bringing one to bag. Dogs are likewise of the greatest service in Cougar and Panther-hunting.

All Bears, including the Grizzly, as well as Panthers and Cougars, will if possible get out of the way of man, and will rarely attack unless wounded, or in defence of their young.

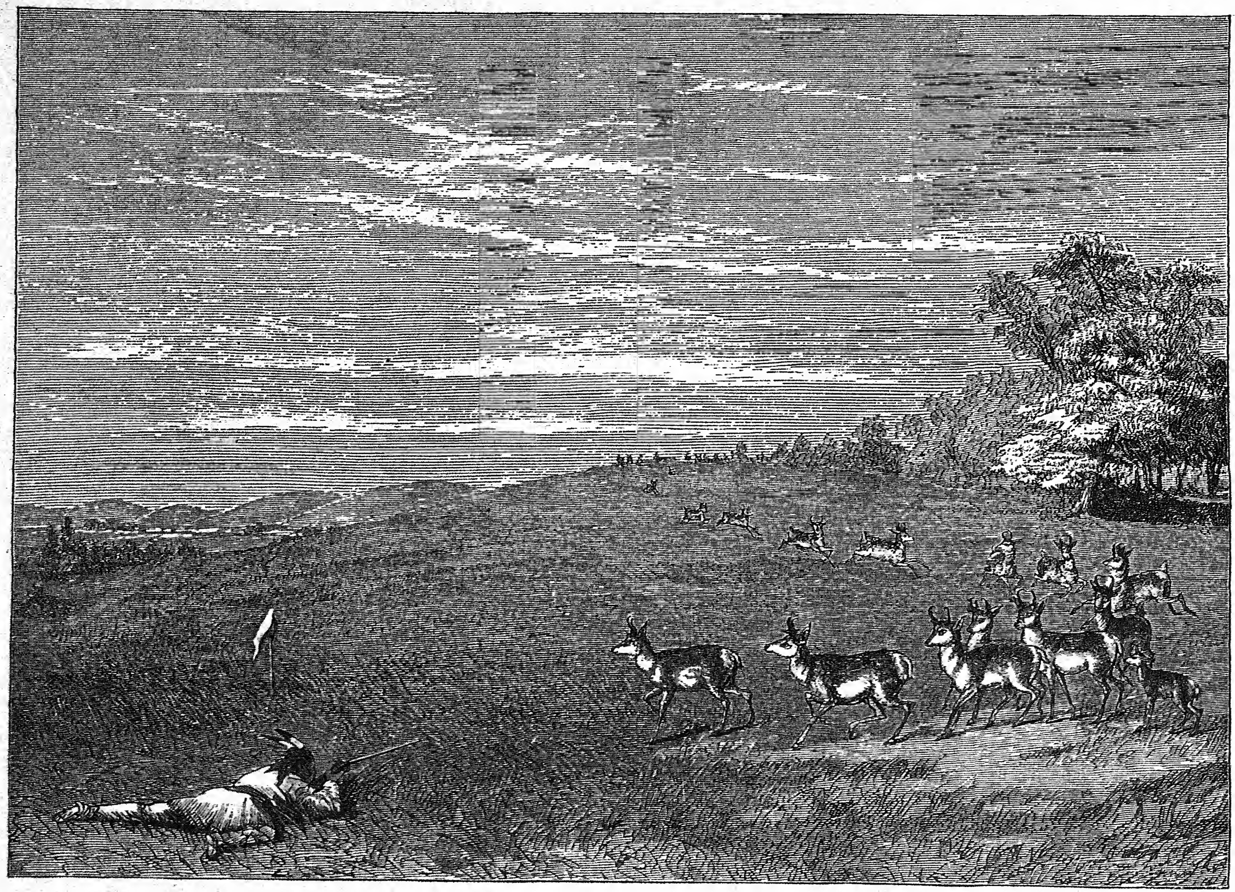
The Grizzly Bear (*Ursus ferox*), is common in California, and often met by hunters after the Bighorn in the Rocky Mountains. It is the most formidable of all the Bear tribe, and often attains gigantic proportions —one specimen exhibited in the United States weighed some 2,000 lbs. It is very tenacious of life, and should be hunted with dogs, a large-bore rifle, and in company.

Stories of "Bar-fites" coming from California are doubtless much exaggerated; but no hunter once in the clutches of a dying or wounded Grizzly can hope to escape scathless; and no man dare close with the Grizzly, as is regularly done in Scandinavia with the common Brown Bear.

According to Caton, the American Deer are of eight kinds:—"The Moose (*Cervus alces*), Wapiti or Elk (*C. Canadensis*), Woodland Cariboo (*C. tarandus*), Mule Deer (*C. marcrotis*), Columbia Blacktail (*C. Columbianus*), Common or Virginia Deer (*C. Virginianus*), Barren-ground Cariboo (*C. tarandus artica*), Acapulco Deer (*C. Acapulcensis*)." Hunters make but four distinctions: Moose, Wapiti, Cariboo and Blacktail.

Game for the shot-gun abounds in every state, the chief game birds being Quail, Grouse (five varieties), Woodcock, Snipe, Wild Turkeys and Wild-fowl.

For Quail-shooting in the eastern states, Ohio, Indiana, Virginia, North Carolina, Kentucky, Tennessee, Arkansas, Wisconsin, Missouri, Illinois and Iowa offer the best inducements. In California it is not unusual to bag fifty couple in a day's shooting; but there two varieties are known both differing from the Eastern Quail, and called respectively the Mountain and Valley Quail. The former are by far the most numerous. The favourite haunts of the latter are the valleys and foot-hills of the Sierra Nevada and coast mountain ranges. In size they are about equal to the Bob-white or Eastern Quail, whilst the "Mountain" Quail is considerably larger, and is to be met with in the more elevated regions.



Antelope Shooting (after *Catlin*).

Grouse-shooting.—The Black-cock is generally known by American frontiers-men as the "Sage-cock." The best localities are on the eastern slopes of the Rockies. Fort Fred. Steele is said to be the best centre for the hunting-grounds of this Grouse.

The "Dusky," "Blue," "Black," or "Mountain" Grouse (*T. obscurus*) is found in almost all the mountainous regions of the west, inhabiting the mountain-slopes from an altitude of 6,000 feet to the snow-line. His close-lying, solitary habits seem to indicate that he belongs to the same branch of the *Tetraonidæ* as the European Ptarmigan; and it affords no better sport, but is an equal delicacy for the table.

The "Sharp-tailed" Grouse, commonly known as the "Willow Grouse" (*T. phasianellus*), is more common in British territory, but has penetrated from the north to the Canadian and Missouri Rivers; it is also found in the west.

The Ruff Grouse (*T. umbellus*) is common in most of the eastern states; it is not often found on the southern plains, but it may often be met with on the foot-hills in timber, it being essentially a covert bird. Large numbers have been killed in the Black Hills, and the surroundings of the Laramie plains.

Pinnated Grouse, or "Prairie Chickens," are most abundant in Wisconsin, Minnesota, Iowa, Nebraska, Kansas, Missouri, Indian Territory and Texas. In some parts of Michigan, Illinois and Indiana they are to be found in small numbers, but are fast disappearing in the eastern states, and, strange to say, appearing in western states where a few years ago they were unknown; they may now be found in some parts of Utah and Nevada, and in great numbers up the Arkansas Valley.

Wild Turkeys afford the best sport of any American birds, being always on the alert, and possessing a most acute sense of smell. Full-grown cocks frequently weigh as much as 20 or 25 lbs. They are most abundant in the less inhabited portions of Western Virginia, North Carolina, Tennessee, Missouri, Arkansas, Mississippi and Texas. A few are met with in Michigan and Illinois, more in some of the southern states, and very many in some portions of New Mexico and Arizona; but in those states situated north of Kentucky and east of Indiana they are rarely, if ever met with.

A species of Rock Partridge is said to frequent north-western Texas

and south-eastern New Mexico. They weigh about 1 lb., and resemble in shape and plumage the "Bob-white." Their favourite resort is the grassy tops of limestone "mesas;" they are found in coveys, and lie well to the dog.

Woodcock-shooting is to be had all along the Valley of the Mississippi and its tributaries, from Minnesota to the Gulf of Mexico. This is the choicest Woodcock-ground, but bags of ten to twenty birds are frequently made in most of the eastern states, as hereafter detailed. None are to be found in California, or, to the best of our knowledge, in any of the Pacific coast states.

Jack Snipe are to be found in quantities in all the resorts to be mentioned for inland Duck-shooting.

The Wild-fowl of the United States comprise the Trumpeter Swan, Canada and White-fronted Goose, Canvas-back, Ring-necked, Red-headed, Scaup, Dusky, Shoveller, Gadwall, Buffle-headed, Wood or Summer, Pintail and Common Wild-ducks; the Blue- and Green-winged Teal, the American Widgeon, and many other birds.

Duck or Mallard-shooting takes place in the marshes in the fall, the cornfields in winter, and in timber in the spring. Decoys, sinks, and other devices are common.

The wild-rice ponds are the best feeding-ground for Ducks in the fall; they are often of wide extent, and as it is impossible to see over the top of the rice, care will be necessary in "taking the bearings," or the wild-fowler may be lost. A pocket-compass is an article of necessity in wild-fowl shooting.

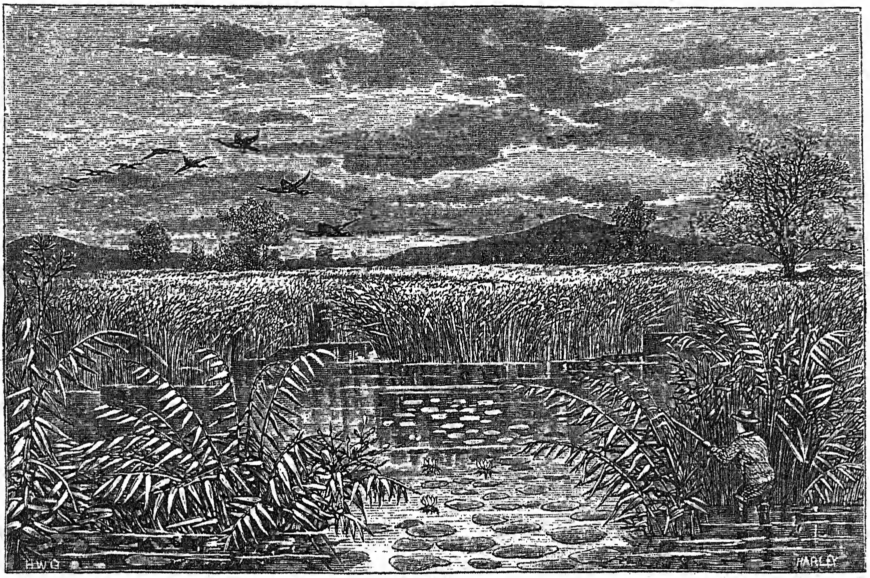
The kind of "ground" the sportsman will have to traverse may be gathered from the accompanying illustration—a wild-rice pond in autumn.

The Wild-fowl resorts of the United States are so numerous that we have deemed it more simple to take each State separately, and give the places most recommended not only for Wild-fowl, but also of every other kind of shooting, and include accounts of such local methods of taking the game as we think may prove of use or interest. We *italicise* those places in which game is most plentiful.

In the eastern or Atlantic States the best places for big bags of Wild-fowl are on the *Chesapeake Bay* and its tributaries, Currituck and Albemarle Sounds, the rice-swamps of South Carolina, and the glades of Florida. To

the westward they are found in fewer numbers, until we reach Indiana and Michigan.

In Maine, Piscataquis County affords the best shooting. The *Moosehead Lake* region is the most renowned; here an occasional Moose, a few Bears, with more Cariboo, Wolves, Rabbits, and plenty of small game—Ducks, Geese, and Ruffed Grouse. Spencer Mountain and *Brassua Lake*



Mallard-shooting in a Rice-pond.

are the best localities in this region. Sebec Lake, in the same county, affords fair sport at Ducks, Grouse, and small game.

New Hampshire.—The north-eastern part of this state affords fair shooting. In Carroll County there are Deer and Bob-whites, in Cheshire County, the lakes about *Keene* abound with Ruffed Grouse, Ducks, Jack Rabbits, and small game. In Coos County, the forests near the Connecticut lakes are said to contain Moose, Deer, Otter, Minx, and small game. For these lakes go to *Island Pond Station*.

Vermont, Essex County, in the north-eastern portion of the state,

reached from Island Pond Station, is a comparative wilderness, and abounds in small game, but nothing very attractive.

MASSACHUSETTS.—There is good Wild-fowl shooting on many parts of the coast and the Elizabeth Islands. In 1880, Woodcock and Quail were very plentiful near West Boylston. The best points for Wild-fowl are Buzzards' Bay, Chatham, Catint Point, Marshpee and No Man's Land. The state is thickly populated; and, although the Wild-fowl shooting is very good, there is nothing to attract sportsmen from any distance.

RHODE ISLAND.—Wild-fowl shooting along the coast is fair. Block Island, South Kingston and Watch Hill are the best resorts.

CONNECTICUT.—In Middlesex County there is Duck-shooting at *Saybrook* Point, and Snipe and Duck near Newhaven. In Lichfield County good Wild-fowl, Grouse, Quail and Woodcock-shooting near the Twin Lakes at Canaan; and fair Duck-shooting at Noahk, New London County.

NEW YORK, the northern portion of this state, is a favourite resort of sportsmen. The Adirondack Wilderness, in extent seventy-five square miles, abounding with small game; its qualities, have, however, been over-rated, and it is much thronged with sportsmen. It is best approached from Martins on the south Saranac. Deer-shooting is practised here in a most unsportsmanlike manner, the Bucks being driven into the lakes, and the sportsmen follow in boats. The Deer are often shot within ten feet of the boat, and it is said that in some instances the boatman has had hold of the Deer's tail before the hunter fired. Grouse, Snipe and Woodcock are plentiful, and Quail and Ducks in season. On Long Island there are Deer, Quail, Ducks, and Ruffed Grouse. The northern portion of the island is fair ground for shooting, and Great South, Peconic and Shinnecock Bays; but all are too easy of access. Good Snipe-shooting is to be had near Cayuga Lake, in the Montezuma marshes; and for Wild-fowl at the Thousand Islands, where also there is Woodcock, Quail and Snipe-shooting. Alexandria Bay is the chief resort at these islands; others are Goose, Eel and Halstead Bays. Camasse, in north-east of Ulster County, is famous for Ruffed Grouse.

NEW JERSEY offers few inducements to sportsmen. There is Wild-fowl on the sea coast, and Duck and Snipe-shooting in *Atlantic*, *Ocean*, and Morris Counties.

Pennsylvania.—Many parts of this state abound with game. Near to the Blue or Kittatiny Mountains, the Sideling Hills and the Alleghanies, are the best game resorts. In Black County, Altoona is the station for good Deer, Partridge and Woodcock ground, with an occasional Bear. Other good ground lies in Cameron, *Clinton*, McKean, Pike, and Potter Counties. Wolves and Panthers are sometimes met with. Deer are not at all scarce, and Ruffed Grouse, Bob-whites, Woodcock and small game are found in abundance.

Virginia and West Virginia.—The latter of these two states offers great inducements to the sportsman. The Alleghany and Cumberland Mountains cover innumerable Deer, and a few Panthers and Bears. Smyth County, in the Alleghanies, Va., Morgan and Tucker Counties in Western Virginia, are noted for sport. *Hoys Wilderness* and the Blackwater region in the latter county is plentifully stocked. Oaklands station on the B. and O.R. is a good starting point. Sport in Western Virginia comprises Black-tailed and other Deer, Wild Turkeys, Ruffed Grouse, Woodcock, Quail, and other small game. On the coast is Chesapeake Bay, the famous Wild-fowl resort; Cobb's Island, the mouths of the Rappahannock, Potomac, Muttopony and Pamunkey Rivers are also visited by large numbers of Wild-fowl.

North and South Carolina.—These states are practically destitute of large game, and offer no inducement for the sportsman to leave the better ground in West Virginia. The coast of the north state is thronged with Wild-fowl. *Beaufort* in Carteret County, *Newberne* in Craven County, and Carrituck County, especially near Knott's Island, are the best quarters; in the first and last Canvas-back Ducks are met with, and in all Black and other Ducks, Geese, Snipe, &c. The southern state has similar Wild-fowl, and a few Deer and Foxes inland.

Georgia.—The sea coast is similar to that of the two preceding states. Wild-fowl are very numerous; and in the County of Bastow there is Turkey and Quail-shooting.

Florida is at present a "sportsman's paradise." Wild-fowl are particularly numerous. especially south of Lake Okee-chopee. The other game consists of Panther, Bear, Red and Virginia Deer, Jack Rabbits, Turkeys, Quail, Woodcock and Snipe, besides Foxes, Racoons, and other minor game in abundance and variety. The St. John's River is a good

point about the centre of the peninsula. The *Indian River Country* up the St. John's River abounds with game. Titusville and Melonville are good places to start from, but a cruise of some weeks round the south and western parts of the peninsula is most successful for all shooting. The Snipe and Duck-shooting is not to be excelled. Hemand County and Homosassa are very good districts, and fairly easy of access. The south-western and southern part of the peninsula is, however, the best; to the south-west of Lake Okee-chopee to Charlotte Harbour and along the Caloo Sahatchie River, Turkey and Deer are unusually numerous. In the western part of the state good shooting may be had from Pensacola, consisting of Bear, Deer and Turkey. In the Grand Lagoon there are myriads of Wild-fowl.

ALABAMA is fairly stocked with game. Deer and Turkey in abundance, and Wild Ducks, Geese, Bears and Foxes in goodly numbers. Choctaw County, in the western part of the state, is good ground for Deer, Bear, Opossums, Turkeys, &c. Clarke County has the same, and along the Alabama River there is plenty of Wild-fowl. Lauderdale County is also very good, and the Muscle Shoals on the Tennessee River swarm with Wild-fowl. In the northern portion of the state, at the foot of the Alleghanies, game of all kinds is plentiful.

MISSISSIPPI is abundantly stocked with Wild-fowl in the western portions. The forests are fairly stocked with Turkeys, Deer, Bears, and small game. Corinth in Alcorn County, Coldwater in De Soto County, Panolo in Panolo County, and Hudson and *Austin* in Tunica County, are near good grounds; Wild-fowl down the Mississippi River, and in the St. Francis Lakes.

TENNESSEE is fairly stocked with Deer, Opossums, Foxes, Wild-fowl, small game, and a few Bears and Turkeys. The famous Red Foot Lake is in this state, near Tiptonville. The lake is thirty miles long, and three to ten wide; and besides excellent Duck, Snipe and Wild-fowl shooting, there is good *bass fishing*. Plenty of birds near *Memphis*, 1883.

KENTUCKY is only famous for its Fox-hunting in the English style. There is a fair quantity of small game and Ducks, &c., down the Ohio, Tennessee, Cumberland and Mississippi Rivers.

ILLINOIS is a similar state, but abounding with Wild-fowl. We can

mention a few of the best only. They are—Henry, Chillicothe, Spring Lake, Liverpool, Havanna, Beardstown and Naples on the Illinois River; Annawan near the Winnebago Swamps, on the Calumet River near Chicago, near Quincey, *New Boston*, Grand Tower near the mouth of the Big Muddy River; and at numerous other places, particular along the Mississippi River. In Du Page County there is also very fair Pinnated Grouse, Quail, Woodcock, Bob-white, and similar shooting.

INDIANA has but little large game, but Pinnated Grouse, Rabbits, Wild-fowl, and small game are abundant. Fort Wayne is near good Grouse, Quail, and fair Deer ground. Blackford, Knox and Laporte Counties are also well stocked with Ruffed Grouse, Quail, Snipe, Woodcock, &c. Vincennes and Montpelier are first-rate head-quarters for sportsmen. For Wild-fowl, English, Beaver, and Wolf lakes, the swamps bordering on Michigan, the Calumet, &c., have been strongly recommended.

OHIO.—This is not an attractive state for the sportsman, and he must for the most part be content with Wild-fowl and small game, such as Quail and Snipe. The best shooting is on the shores of Lake Erie, near Sandusky City, or Cleveland.

MICHIGAN is one of the finest sporting resorts accessible to the general sportsman. Northern Michigan is best for sport. Near *Negaunee* there is fair Deer-shooting, and the whole country beyond Escanaba is fairly stocked with Deer, fur-bearing animals, and small game. In the northern and more inaccessible part of Michigan Bear and Deer are plentiful, and good sport is to be had. Wild-fowl shooting (good) is to be had almost anywhere along the borders of the great lakes, and especially on the *St. Clair Flats*, near Detroit. There are many islands in the lakes famous for shooting, notably Royal Island, St. Ignace, and the Apostle Islands (twenty-seven in number).

WISCONSIN is fairly stocked with large game, and has Wild-fowl and small game in abandance. For Wild-fowl the best resorts are Horican, *Puckaway* and *Koshkonong* Lakes, also Lake Winnecome, and the numerous shallow inlets and bays along Lake Michigan, and the low lands of the Chippewa, St. Croix and Mississippi Rivers. For large game the north and north-eastern provinces are likely to prove the most successful. Plenty of Deer near Noquebay Lake in 1883.

MINNESOTA.—The "Land of Lakes," undoubtedly the fisherman's

paradise, is very fairly stocked with large game, and abounds with Wild-fowl, fur-bearing animals, and small game. The North Pacific Railway runs through some of the best hunting-grounds of North America. Duluth is a good place to start from; Detroit and Fargo on the North Red River are excellent starting-points farther west. The Red Lake region and Fort Pembina are recommended for large game; whilst for Duck-shooting one cannot go wrong, there being more suitable feeding-ground for Waterfowl in this state, probably, than in any other state in the Union. There are likewise Grouse, Woodcock, and Snipe in abundance. Prairie Chicken and Quail in abundance near *La Verne* and St. Paul.

IOWA is not celebrated for large game, but is excellent for its Pinnated Grouse and Duck-shooting. For Duck and Wild-fowl, *Comanche*, on the Mississippi, is a good centre; but all along that river, and the Missouri, and the hundreds of small, muddy-bottomed streams and ponds throughout the state, the sportsman can scarcely fail to make a large bag.

MISSOURI.—The south-eastern part of this state is excellent Wild-fowl ground. In some of the forests north and west there is a fair sprinkling of Deer, and a few Turkeys. For Wild-fowl the Mississippi offers the best ground, and also the *Little*, Black, and *St. Francis* Rivers, and all about the sunken lands near New Madrid. These grounds extend into Arkansas, and along the Castor, St. Francis, Black, White, Little Red, Arkansas and Washita Rivers, and at the numerous lakes along the Mississippi, as the Big, Swan and Cottonswood Lakes. Farther north there is good shooting near Hannibal and Lagrange.

ARKANSAS is well supplied with large and small game; but to reap the full benefit it is requisite to camp out. Start from *Texarkana* for Bear, Deer, Wild Turkey and Grouse shooting, or *Forest City*, forty miles below Memphis, for large game and innumerable Wild-fowl. Small game is general throughout the state.

LOUISIANA is very well stocked with game. The north is well timbered, and intersected with numerous *bayous*. In the south the many bays, lagoons, marshes and cane-brakes are swarmed with Wild-fowl and Alligators. For Wild-fowl the mouths of the Mississippi are without parallel. In the cane-brakes are many Bears and Turkeys, both of which are hunted by dogs. The north and centre abound with Deer, Turkeys and Rabbits,

whilst Bears are numerous, and, in the season, Snipe, Woodcock and Quails in large numbers. Alexandria is strongly recommended for this shooting.

TEXAS.—This state, with an area of nearly 240,000 square miles, contains some of the finest hunting-grounds in the world; but, for the most part, difficult of access. The coast all along, and especially about Galveston and the mouth of the Rio Grande del Norte, abounds with various kinds of Wild-fowl. Houston is a much-visited centre for Deer, Grouse and Quail-shooting. Bears, Deer, and like game are general in the wooded parts of the state. Northern Texas is the home of the Buffalo, but the ground is best approached from Kansas. This and Western Texas are well stocked with all kinds of game found on the plains; but owing to the numerous Indians, and the still more numerous white thieves, none but a large and well-escorted party dare cross the Llano Estacado or the Rio Pecos. The most available ground from the south lies to the west of San Antonio. In Texas "fire-hunting" is practised for Deer, and Antelope are in some districts very numerous.

INDIAN TERRITORY abounds with game of every description. It is, however, against the law of the United States for any white man to kill game on Indian reservations.

NEW MEXICO likewise abounds with game, and is infested with robbers and difficult of access, but will shortly be opened up by the completion of the Atchison, Topeka, and Santa Fè Railway. Excursions may be made from the advanced posts on that line with fair success, but the toil in most cases would exceed the sport.

ARIZONA is well stocked with game and Water-fowl. Yuma may now be reached by rail from California. It is a mountainous country, and up to the present chiefly occupied by miners. The next few years will doubtless open up this country wonderfully, when it will be the finest hunting-ground west of the Rockies. Camping-out in large companies will, however, be necessary for several years, and the best districts are most difficult and dangerous to get access to.

CALIFORNIA abounds with many varieties of game. Nevada County is one of the most accessible for game, and the regions of Lakes Tahoe and Independence (reached from Emigrant Gap Station, U. P. R.) are famous for Bear (Grizzly) and large game. The Oregon Branch of the

Central Railway runs through a fine shooting-region. The San Joaquin Valley is also good ground, and from Los Angeles may be reached the *Big Pine Mountains*, where game of all kinds is very numerous. There is also a good district near *Humboldt Bay*, in the north, reached by steamer from San Francisco. The peninsula of Lower California is too wild and remote a region to offer special inducements to sportsmen. In many parts of California Wild-fowl are so numerous as to necessitate the posting of guards about newly-sown grain-fields to protect the crops. The resorts are very numerous, some of the most celebrated being the San Joaquin and Sacramento Rivers, the mouth of Feather River, Cash Creek, Tomales, Suiscun, Sonoma and San Francisco Bays, Tulare and Clear Lakes.

NEVADA is not an attractive country to the sportsman, being for the greater part desert land. The best game resorts lie within easy distance of the C. P. Railway. The Humboldt Range is fairly stocked with game; the Sierra Valley is a favourite resort, and reached by stage from Reno. *Washoe County* is the best stocked—good starting-places and head-quarters being Virdi, Washoe City and Wadsworth. Winnemucca, Wells, Carlin and Elko are in the midst of a good Antelope, Deer, Grouse and Duck country. At the first there is also the chance of Black-cock and Bighorn.

UTAH does not abound with large game, but is fairly stocked with Antelope, Black-cock, and other Grouse; and on the Great Salt Lake there are plenty of Geese, Ducks, Swans and Wild-fowl. Ogden has fair sport in its neighbourhood.

COLORADO is and is not recommended for large game shooting. It seems that in Colorado game, although not scarce, is by no means so plentiful as in Wyoming and Montana. Near Denver there are Grouse, Quail, Geese and Turkey. For larger game the North and Middle Parks have been recommended. Manitou, Estes Park and Central City are in the neighbourhood of Antelope, Bear, Deer, and a little Wapiti shooting. There are several varieties of Ducks and Geese, but Wild-fowl and small game is not so abundant as in other states.

KANSAS was once the sportsman's paradise, but is so rapidly settling-up that it is not safe to recommend it for large game. There are, or were, plenty of Antelope, but the enclosure of the land for *sheep farms* has greatly interfered with the habits of this retiring animal. Some of the best shooting may be had from the stations on the Kansas Pacific and the

Atchison, Topeka, and Santa Fè Railways. Hutchison, on the latter, is a good starting-place for the Antelope country. Fort Dodge is also in a good country. Turkeys are not scarce, and Grouse and Quail may be shot anywhere west of Salina. This was once a great Buffalo country, but for that sport see ante.

NEBRASKA is fairly stocked with Elk, Deer, Antelope, Turkeys, and goodly numbers of Grouse, Rabbits and Wild-fowl. For Elk the Loup fork of the Platte River is said to be very good; other stations are in Dawson County. Near the borders of Wyoming, Deer and Antelope are fairly plentiful. Antelope and *Ogalalla* stations have good ground in their vicinity. For Wild-fowl the Elkhorn Valley is a good district, but they are pretty numerous throughout the state.

WYOMING is, as we have already mentioned, the best locality for large game in the states—Wapiti, Buffalo, Deer, Antelope, Bears, Moose and Mountain Sheep being quite numerous in some districts. The Laramie Plains, the Tremont Park, and especially the Bighorn Mountains, Wind River, and Yellowstone Valley regions are, it is reported, alive with game. Buffalo are found chiefly in the northern part, but see Notes, ante. Bears chiefly in the Black Hills; Antelope, Deer, and small game everywhere.

DAKOTAH.—This territory contains the larger portion of the Northern Buffalo Range; it is sparsely settled, and contains large and numerous Indian reservations. Bismarck, the present terminus of the North Pacific Railway, is a good starting-point. The ground may be reached from Rawlins on the U. P. R. There is game in abundance, but camping-out is necessary.

MONTANA.—This territory also includes part of the Buffalo Range. Game is in great abundance throughout the territory. Rawlins or Bismarck may be made starting-points. Helena is a good centre to work the Missouri valley. The finest natural scenery and sport are to be found in this territory, but at present it is difficult of access.

IDAHO.—This mountainous territory is but little known. For sport it is second only to Montana. Buffalo will not be found in quantities, if at all; but there are plenty of Deer, Wapiti, Bears, and a few Panthers and Antelopes; Wolves, Foxes and fur-bearers are in any quantity. Its inaccessibility makes it more the paradise of the trapper than the sportsman. Sportsmen usually start from Kelton station, N.P.R., and fit out at Idaho

City or Boise. The Snake River region is one of the most accessible and best.

OREGON is a fine field for sportsmen, but difficult of access. In most of the valleys large numbers of Elk and three other varieties of Deer roam almost unmolested. The Yaquina Valley and Cascade Mountains are the finest regions; Antelopes are very numerous in the latter; Quails, Grouse, abound in great numbers, whilst there are myriads of Geese, Ducks, and other Wild-fowl. The country is rich in the common fur animals, and also Silver Foxes, and Pumas or Cougars. The best way is to go from San Francisco to Portland by steamer; fit out there, and camp out until satiated with sport and laden with spoil.

WASHINGTON TERRITORY also abounds in large game, fur-bearing animals, and all kinds of feathered game. The only difficulty is the trouble of getting there, and then getting safe back to the settlements with the spoil. Vancouver is a good place from which to fit out.

ALASKA.—This recently-acquired territory of the United States is in regular communication with San Francisco by steamer. It is a wild, boggy country, rich in fur-bearing animals, notably the fur-seal; and Fish, Bears and Deer are fairly plentiful: but it can never be recommended as a sporting locality, as it rains almost incessantly nine months out of every twelve, and its inhabitants are amongst the most degraded of aborigines. Of the unexplored country inland, it is conjectured much must be valuable and habitable, but near the coast the average rainfall is 86 inches yearly.

CANADA AND BRITISH NORTH AMERICA.

The remarks as to camping-out, made at the commencement of the Notes to the United States, are equally applicable to Canada; but throughout British territory it is the rule to hunt along the valleys, and travelling for the most part is done in canoes or sledges.

To those who require plenty of sport and can spare the time, a trip to Lake Winnipeg is likely to prove the most interesting and successful.

The Northern Buffalo Range extends into British territory towards the great Slave Lake and Mackenzie River. They can generally be got along the Saskatchewan or Athabasca Rivers; but the sportsman who would

visit these regions must be prepared to "rough it," and expect the roughest that elastic term can import.

In the far north-west the only way to travel is to accompany some of the fur-traders in the employ of the Hudson Bay Company on their periodical visits to their distant stations. The living is hard, and the sport meagre; in fact, *le jeu n'en vaut pas la chandelle*, much better districts being more easy of access. Large game is not abundant far north, and in Caledonia, besides fur-bearing vermin, there are only Rabbits and Salmon, the inhabitants dragging out a miserable existence upon these.

In Canada proper and Manitoba, game may be had with a fair amount of trouble. In the north and west of Ontario and Quebec game is found in good quantities; but Canada offers more inducements to the fisher than the shooter. The *Quebec country* is good shooting-ground; the regions along the Jaques Cartier and St. Ann's Rivers contain fair Cariboo and Moose ground; Ducks and Wild-fowl are plentiful.

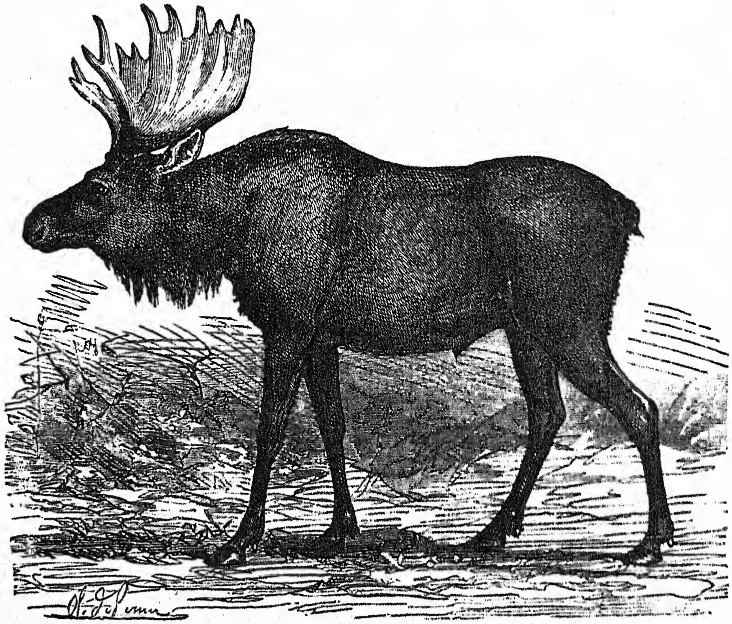
In Ontario there is good Wild-fowl shooting on Charleston Lake in Greenville County. In the Ottawa district are a few Bears, Foxes, and good Rabbit and Grouse-shooting. There are several lakes near Young's Point, around which plenty of Deer are to be found. Lakes Simcoe, Misskoka, and Cocochong are famous for fish and Ruffed Grouse. The Coulonge district is famous for Bears, Wolves, Cariboo, Moose, and large game, but is inferior to a well-known district 100 miles west of it, that abounds in lakes and may be reached by canoes. The northern shore of Lake Superior is a famous game resort, and is known as the Algoma country; it is reached by Lake Superior steamers.

In Nova Scotia and New Brunswick the most attractive game is Moose. The Canadian Moose is the largest of the Deer tribe, often measuring 5 feet 6 inches to the shoulders, and weighing 1,200 lbs.

Moose-hunting is practised in three ways: the one most in favour, "calling," can only be practised in the rutting season, September and October. Moose "creeping," or stalking, is a long, wearisome, and often futile excursion, and only followed by the keenest and hardiest of sportsmen and Indians. "Moose-running," or following Moose on snow-shoes when the snow has a hard, brittle crust upon it, so that the Moose breaks through the crust and flounders in the deep snow, is a one-sided affair, and hardly worth the name of sport, the sportsman being practically *certain* of

his game. For Moose-calling or creeping the services of an Indian are requisite; the charge averages about a dollar and a half per day.

From Halifax, Nova Scotia, excursions may be made after Moose and Cariboo. Parrsboro', in Cumberland County, is a good place, and has also Woodcock, Duck, Snipe, and occasionally Bears are met with. In the south, Annapolis, Yarmouth and Linenburg Counties are fair resorts for



The Moose (*Cervus alces, Linn.*).

Moose, Bear, Cariboo, and smaller game, but not so good as Cumberland County. There is also a good Moose region near Port Mouton, in Queen's County, and Wild-fowl and small game are plentiful. New Brunswick has plenty of Moose and Cariboo, and there are also a few Bears, and quantities of small game. The *Miramichi* district is one of the best; fit-out at Fredericton. Other good regions are on the Ristigouche, Tobique and Nissisiguit Rivers.

All along the coast of Labrador there is abundance of Wild-fowl, including Ducks, Teal, Brant and other Geese, and Widgeon. Newfoundland has also several varieties of Wild-fowl and small game; large game is scarce, but there are Bears, Cariboo, Otter and Foxes to be had by perseverance. In British Columbia game is plentiful and varied. There are a few Elk, two or three varieties of Deer, the Musk Ox (*Bos moschatus*) several varieties of the Grizzly Bear (cinnamon, silver-tipped, &c.), Black Bear, Wolves, Lynxes, Foxes and many fur-bearing animals. Wild-fowl, including Duck, Swans and Geese, are abundant. On Vancouver Island there are Elk, Bear, and small game, but the chief shooting is at Wild-fowl, of which there is an unlimited quantity.

CENTRAL AMERICA.

The provinces of Guatemala, Honduras, San Salvador, Nicaragua, Costa Rica and Panama, are but little known. Naturalists and explorers have penetrated the thick virgin forests of tropical growth, and reported seeing and shooting large quantities of game, but up to the present time no one has visited any of these provinces solely for sport.

The unhealthiness of the climate, and the numerous difficulties of travel shut up for the present these fine hunting-grounds; but the Pacific Canal or Railway will doubtless open up some of the country to Europeans. We shall, therefore, confine our remarks on game to Nicaragua, as being the most likely country for sportsmen, and the one that will doubtless soon be accessible.

Nicaragua, besides its deadly climate, has many minor drawbacks to inconvenience sportsmen and travellers, not the least being Mosquitos, Garrapatas, and other tiresome insects, besides the innumerable hideous and loathsome reptiles which teem in all tropical forests. Jaguars (called "Tigers") haunt the camp at night, and the Puma is particularly numerous. Tapirs and Deer are extremely plentiful. There are also Lynx, "Tigrillos" (Black Mountain Cat), Racoons, Pisotis or Quasges, Wari (*Dicotyles Jacaçu*), Alligators, Monkeys, Peccaries, and many other animals. Of Birds—the Turkey (termed "Guan") is most esteemed; Curassow is also good eating. There are also Trogons, Orioles, Herons, Egrets, Quail, Macaws, Plover, Partridge, Chaloca or Prairie Fowl, quantities of small

Pigeons and Water-fowl. On Lake Nicaragua Wild-fowl are particularly numerous.

In most of the rivers are to be found Alligators, Turtles, and the Iguana and other large Lizards in their vicinity.

MEXICO.

Mexico at present is not desirable ground for the sportsman. Game is not scarce, but the obtaining of it is beset with many difficulties, and Europeans, especially Anglo-Saxons—who often pass as "Texanos"—are not well received by the native Mexicans; and owing to the prevailing lawlessness, are often in positive danger in the more remote regions. That the country will prove a fine hunting-ground is not doubted; but as to that time, *Quien Sabe?*

The Mexican Lion, Cougar, *Gouazouara* or Puma (*Leopardus concolor*), is common in Mexico, especially in the Sinaloa region. Bears are also common. Of Antelope and Deer there is abundance. Buffalo is to be had in the north-west provinces of Chihuahua and Sonora, but the region is too much infested with thieves to make Buffalo or any other hunting a sport.

The Turkey (*Meleagris gallopavo*) is common throughout the country, as are Quail, Snipe, Grouse and Water-fowl. The naturalist may get the Harpy-Eagle, the Ivory-billed Woodpecker, Trogons, Curassows, and other rare and interesting birds, and in the course of time the sportsman may depend upon obtaining good *sport* in Mexico. At present the country is "tabooed," to all but adventurers and enthusiastic naturalists and travellers.

SOUTH AMERICA.

Game in South America is plentiful, and the country offers many inducements to the sportsman who can "rough it," and has mastered the French and Spanish languages.

From May to August the country may be considered healthy, yellow fever seldom appearing in the wet season, and it is at most only a coast disease; the interior high-land is exceptionally healthy, but the low-lying swamps of Venezuela, Guiana and Ecuador are subject to the same

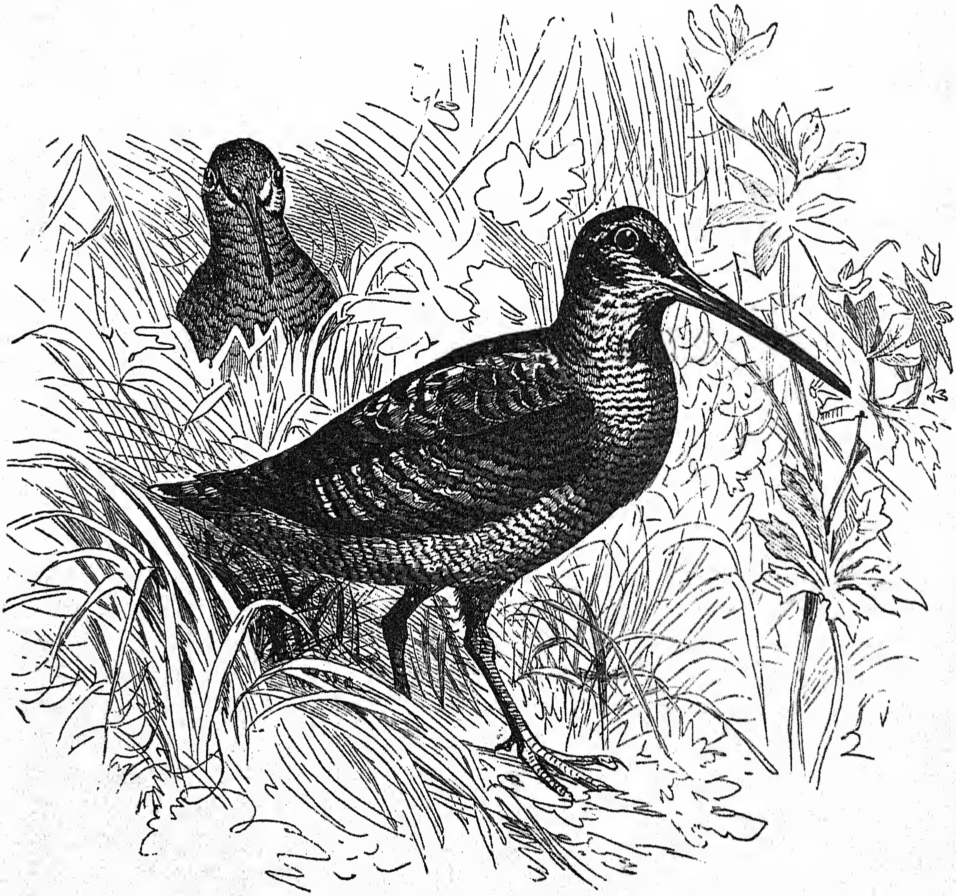
objections as other tropical regions. A good way to get sport is to charter a yacht from Monte Video, and cruise down the coast of La Plata and Patagonia. By making the yacht the head-quarters, and travelling inland a few miles, good sport can be had at Vicuñas, Deer, Hares, Rheas, Geese, Partridges, Quail, Duck, Snipe and Ibis. Game is very plentiful from Cape Corrientes to the Welsh colony of Chupat.

In any of the South American Republics it will be necessary to carry a revolver, and it is advisable to wear it in as conspicuous a place as possible. Guns, 12-bore, an Express rifle, ·450-bore, revolvers, cartridges, powder, saddle and blankets should be taken from England. The weapons are mostly of French and Belgian make, and very common and worthless. Ammunition is vile, especially the French powder. English powder sells from six to ten shillings per lb. at Monte Video.

As may be imagined, the best sport is got in the interior: the Andes and Corderillas affording some of the best; but the shooting within reach of some of the larger towns is by no means despicable. Bolivia and Paraguay are certainly the best regions for sport, but we will detail the shooting of each country in order.

The United States of Columbia, Venezuela and Guiana offer less inducements to the sportsman than to the naturalist. Owing to the thickness of the scrub, the forests are impassable; and cutting a pathway is too slow and laborious an undertaking for sport, and it would, moreover, scare the game from the vicinity for several days. The only places for sport are the watercourses; and by using dogs to drive the game into the water, good bags can be made; but the shooting is akin to pot-hunting. The game consists of small Deer (*Moschus*), Labas, Hogs, Peccaries, with occasional chances at Jaguars, Pumas and Tapirs. The Jaguar (*F. onça*), or the American Tiger, is not to be compared with the Asiatic for size or ferocity. It measures about seven feet in length, and seldom attacks man. It may be found in the denser thickets near the watercourses, especially the "igaripès." Llamas, Vicuñas and Guanacos can also be obtained in the Cordilleras in Colombia, and sport is better there than in Guiana. Of birds there is a large variety, including Turkeys, Plover, Ibis, Muscovy and other Ducks, Snipe, &c., besides numerous birds—as Trogons, Caracara and Harpy-Eagles, Flamingoes, Jabiru, Curassows, Toucans, Macaws, &c., shot for their plumage. In Guiana, the Corentyne River is

the best; fair sport at Birds and Peccaries near Demerara, but not very attractive; the Essequibo River is the one most shot over, and game on its banks are wild.



The Snipe (*Scolopax major*).

In ECUADOR there is very little game on the coast, except the usual Sea-fowl and Pigeons. The sport in the interior is very fair, but long excursions are necessary.

In PERU the most successful shooting expeditions are down the

rivers to the east of the Andes. On the sea-coast game is scarce, and consists of Francolin Partridges, Pigeons, a few Snipe and Quail, and uneatable Sea-fowl. By floating down such rivers as the Marañon or Ucayli, the following game will be met with: Manati, or "Vaca marina," Jaguars, Pumas, Tapirs, Wild Hogs, Peccaries, a gigantic species of Guinea Pig, called "Majaz," Armadillos and other small mammals, Turkeys, Ducks, and numerous other birds, with abundance of Fish, Turtles and Alligators. In the mountains are Vicuñas, Vizcachas, Guanacos, Llamas, Rheas, Partridges, &c.

Bolivia.—The quality and variety of its game is unrivalled by any South American province. The best regions are the high levels of the interior; the "Bolivian Plateau" lying between the Andes and Lake Poopochoro, has been recommended. It is not, however, necessary to travel so far into the interior for game; Guanaco, Ostrich (*Rheas*), Vizcachas, Ducks, Snipe, Partridges and Hares are to be got in the Tacora or western Cordilleras, within two days' journey of the port of Arica, in Peru. The Great Lakes, Titicaca, Poopochoro, and the Paripiti Marsh abound with Wild-fowl and the usual large game, Deer, Guanacos, &c., on the surrounding pampas. Game is also plentiful on the route to Oruro, Yululeo, Tariia, La Paz, Luque, Huata, and Asunçion; very little near the Pacific coast or the Salina de Atacama. On the "Platas" a couple or more greyhounds afford good sport by running Rheas, Deer and Hares; and this sport is as often practised as shooting.

Brazil.—For sportsmen, south Brazil has more attractions than the northern tropical regions. The provinces of Sao Paulo, *Parana* and Rio Grande de Sul abound with small game, more especially with Snipe, which are perhaps more plentiful in some parts of Parana than in any other part of the world. Near *Curitaba* Snipe, "Tinamou," or Partridge, Ducks and Geese are very plentiful, and Hares, Deer, Rheas and Armadillos fairly numerous. On many of the tributaries of the Rio Parana, and smaller watercourses in S. Paulo and Parana, Tapirs, Jaguars, Wild Pigs, Otters, Deer, Yacus, Juallatas, Ducks and Wild-fowl will be met with. In the northern and western provinces the game is similar to that found in Guiana, and includes Pumas, three species of Ocelot, the Ayontis (*Dasyprocta acuti* and *Cristata*) are also particularly numerous, and keenly relished by Brazilians and Indians; they resemble Guinea Pigs,

but are considerably larger than the English Hare. Manatis, or "peixe boi," are common in all the rivers, and Tapir, Jaguars and Curassow, Gauzu-riva, Cuguacu, &c. Deer numerous.

IN URUGUAY are found two kinds of Partridge—one the size of a Pheasant, the other smaller than the English Partridge. There are two species of Swans—one white, the other black and white. The American Ostrich (Rhea), Herons, Storks, Egrets, Spoonbills and Flamingoes, although not common, are often met with.

There are three species of Duck—"Pecaso," "Caroso," and "Overo;" the first-named is the finest. Blue and Brown Teal are common, Sandpipers, Golden and Spur-winged Plover or "terru-terru," and Snipe are particularly numerous. There are Musk Deer, "Guazupuco," Foxes, Hares, and the "Carpincho" or "Water-pig." Very fair sport at the above-mentioned game can be had in the district of Colonia, but by going further inland, the "Bandadas" of Ostrich are more numerous, and the Deer finer, resembling the Fallow Deer. Coursing is much practised.

PARAGUAY is one of the finest hunting-grounds of South America, and is easily reached by steamer from Buenos Ayres. From Corrientes to Asunçion the banks of the river are alive with animals and birds. There is very good sport near Villa Rica, Trinidad, and also up the river to Concepçion. Very good sport in *El Gran Chaco*, in La Plata, on the right-hand bank of the Parana, and along the Pilcomayo and Confusio Rivers.

On the mountains are to be had Guanaco (Llamas), Vicuñas and Vizcachas, large Partridges, &c. On the plains and lowlands—Snipe, Water-fowl, Partridges, Rheas, Guazu-pytas, Wild-pigs, Jaguars, Pumas, Ocelots, &c.

LA PLATA, OR THE ARGENTINE REPUBLIC.—Good shooting, as we have already noticed (Paraguay), on El Gran Chaco, in the north-east. In the province of *Entre Rios* there are Jaguars, Carpinchos or Water-pigs, and many other animals common to South American forests. Game is very abundant, no one having time to hunt. In the province of *Buenos Ayres* game is also plentiful, and Deer, Guanacos, Rheas, "Martinetas," Patagonian Hares, "Mulitas," "Peludos," "Pavo-del-Montes" (Turkeys), and other smaller game. Coursing is much practised in this part of La Plata.

In *La Plata* game is plentiful, especially Guanacos and Deer, with good numbers of Vicuñas. The Patagonian Hare, Rheas and Turkeys, are also common. Guazupucos, Magames, Vizcachas and other small animals are very numerous. April to June is the best time for game, and the climate then is most enjoyable and healthy. In northern Patagonia similar game is plentiful, but in the southern districts the country is barren and almost desolate.

CHILI.—No sport worth mentioning is to be had in southern Chili. In the north and centre are Guanacos, small Deer, Pavos-del-Monte, Francolin Partridges, Snipe, Ducks, and Wild-fowl. Near the coast the sport is next to worthless, consisting of Francolins and Sea-fowl. Very fair sport may be had two days from Valparaiso towards Aconcagua. In the north are many Guanacos and fewer Vicuñas, but the best grounds are on the eastern slopes of the Andes. Englishmen, or "Gringos," as they are contemptuously termed, are not liked in Chili, and travelling is uncomfortable and dangerous. A revolver is necessary, and will often have to be shown; but there is seldom any necessity for it to be used.

OCEANIA.

AUSTRALIA.

The shooting in most parts of Australia is confined to feathered game; but in many parts of Queensland, and in some of the more remote districts of Victoria, New South Wales, and South Australia, there is fine sport at the so-called Marsupalia and at imported game.

The Acclimatisation Society have introduced Pheasants, Hares and Deer, all of which are rapidly increasing. Partridges have not been so successful. Rabbits are too numerous; and thus in a few years' time Australia will be able to offer good and well-varied sport to the shooter. At present Deer and Pheasants are not shot, but Hares may now be shot in season.

The Marsupials include Wallaroo, Wallabies, Kangaroos, Koolas, Paddy Melons, Opossums, Kangaroo Rats, Otters and Porcupines; in all there are fifty varieties, affording sport according to their size and habits.

The feathered game includes nearly thirty varieties of Wild-fowl,

Quail, Snipe, Pigeons, Scrub and Plain Turkeys, besides Emus and many other birds of interest to naturalists.

The Wild-fowl consist of Black, Wood and Whistling Ducks, Teal, Widgeon, Black Swans, Grey and Magpie Geese, Cranes, Spoonbills, Pelicans, Grebes, Coot, Shag, Water-hens, and many others too numerous even to mention. Of Pigeons, the most common is the "Bronze-wing;" "Squatter" and "Crested" Pigeons are fairly numerous, and inland is found the "Flock Pigeon" and the "Wonga-Wonga," the largest of the Dove tribe.

In some districts there are large numbers of "Wild-hogs" and "Horses," both of which are shot as pests.

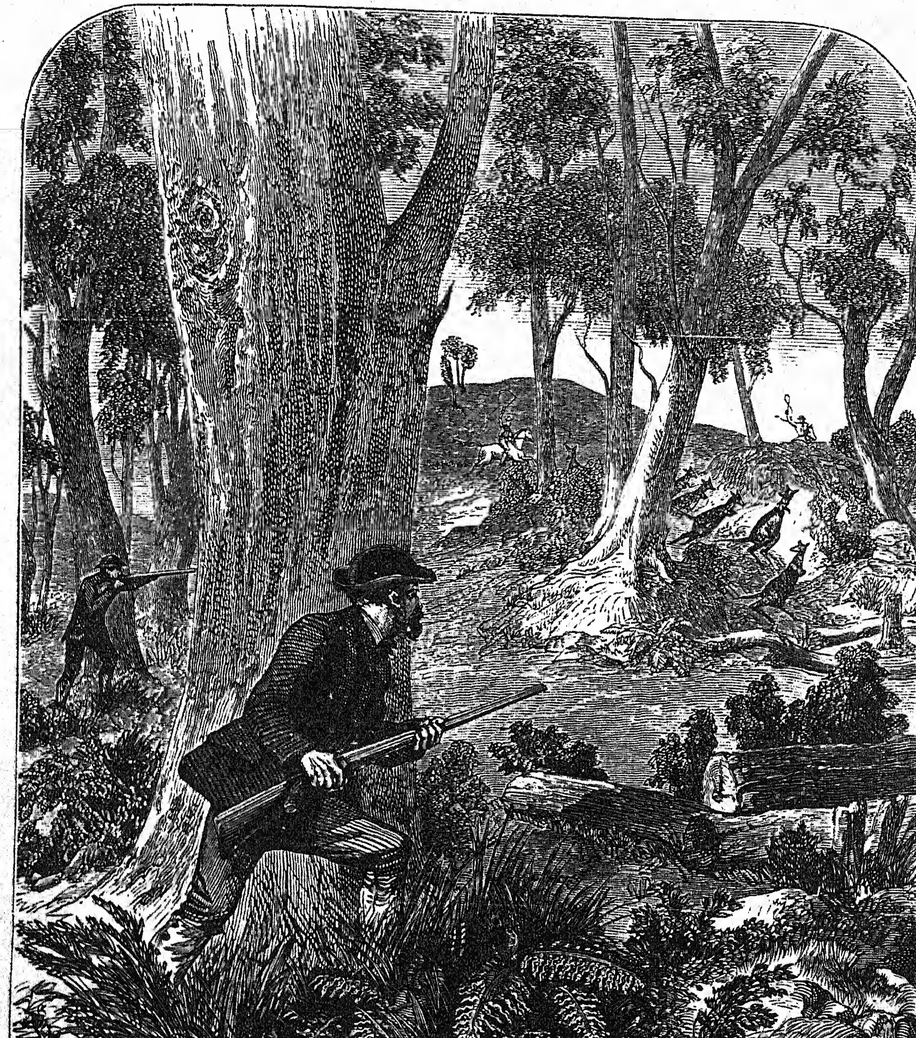
In South Australia and Victoria, there are several packs for hunting the Wild-dog or "Dingo" in a similar manner to English Fox-hunting. On the coast, "Dugong" (*Halicore Australis*) may be harpooned, shot, or taken in nets.

These remarks serve to show that shooting is by no means a dead-letter in Australia; and, although the country has not sufficient game to attract sportsmen, those who visit it for health, business or pleasure may get fair shooting, whilst the extraordinary animals peculiar to the country will prove most attractive to naturalists.

As a rule, game is scarce near a mining camp, nearly every miner being possessed of a gun, and killing upon every opportunity. At Melbourne, Sydney, Brisbane or Adelaide, there are gun-makers and stores where arms, ammunition, and everything needful for Colonial sport may be obtained. As a rule, no gun license is required. For outfit a small-bore rifle, ·360 or ·400, is useful when Kangaroo-stalking or Plains Turkey (Bustard) shooting. For other purposes, a good Choke-bored gun of 12 guage is best. Stanchion guns are used inland, and there are many punt guns in continual use along the coast.

GAME RESORTS.

VICTORIA.—Within ten to fifty miles of Melbourne, very good Hare and Rabbit-shooting is to be had; can be easily reached by rail, and settlers are generally glad to see sportsmen. Fair Snipe-shooting is to be had latter end of September and October, near *Crambourne*, two hours' drive



A Kangaroo Drive.

from Melbourne; but much better in Gippsland, 100 miles by rail. For Turkey, Ducks, Swans, &c., as good a resort as any is in the *Gippsland* lakes and rivers; also by taking rail to *Echuca*, on the Murray River, 160 miles from Melbourne. Fair shooting also at Westernport, forty miles; but the further regions better repay the visit. Quail are very uncertain in Victoria, being sometimes very numerous, generally after a wet season, and at others scarce. They are frequently found on the Werriba Plains, fifteen miles from Melbourne, but better ground is on the Runnymede Plains, 130 miles by rail, or on the Murray River flats. Wild Turkeys or Bustard are chiefly found in the north districts; across the Murray River is a good place for them. They are grand birds, averaging from 9 to 20 lbs., and sometimes reaching 27 lbs. weight; they are very shy, may be stalked with a rifle, or shot from a horse or trap. Geese, Plover and Water-fowl are plentiful, and may be had near all the rivers and water-holes; Kangaroo and Emu on some of the more remote runs. *Close times* for Ducks, Swans, Pigeons, Turkeys, &c., &c., from 1st August to 20th December; for Hares, 1st September to 1st March; for Quail, 1st August to 1st February. Snipe, Kangaroo and Sea-fowl not protected.

SOUTH AUSTRALIA.—This country possesses the same game as Victoria, but in greater abundance. The interior of Australia is not a desert, as generally supposed; grassy land, small streams, lakes and water-holes are general throughout north, south, and west Australia, and the same game is met on all. At Berlina, 700 miles north of Adelaide, is the limit of the settlements, and game there is far too abundant, and it of course may be had to satiety much nearer Adelaide.

NEW SOUTH WALES has abundance of game at distances remote from mining-camps. Along the Murray River, Wild-fowl and Bustards are to be found in great numbers. On most sheep-runs fair shooting is to be had, with abundance of Kangaroo and Emus in the more remote districts. In New South Wales there is a *close time* for all native game-birds and Water-fowl from 1st of August to 20th of February. Imported game is not yet allowed to be shot at any season, except Hares.

QUEENSLAND is well stocked with native game. Battues for Kangaroo-shooting are sometimes arranged, the battue extending in some cases over several weeks, many thousands being killed. Snipe are fairly plentiful and large, often weighing six ounces; Black Swans, Geese, and Flock-pigeons

are also numerous. Along the coast north of Herring Bay, Dugong-fishing is considerably practised.

For Snipe, good shooting can be got near Brisbane in August and September, at Yandilla, and in many parts of the country accessible by rail. A visitor may safely put himself in the hands of Mr. John Lemon, Imperial Hotel, Brisbane, for information.

For Wild-fowl, there are Ducks at Ennoggera, eight miles from Brisbane; excellent shooting all round Moreton Bay, an extent of 200 miles. A convenient way is to charter a cutter for a few days, with shooting-punts, and pull up the many rivers running into the bay; Pine River is a very good one. Curlew and Plover can be had at same time, and excellent fishing.

Starting from Toowoomba, 100 miles from Brisbane, over the Darling Downs, good Turkey (Bustard), Scrub Turkey (Tallegalla), can be got; also Quail, and any amount of Kangaroo and Wallaby stalking, with perhaps a chance at several droves. The Scrub Turkey is found all round Brisbane and up the coast. Quail, the best Australian game-bird, is very plentiful in the season around Gympie (100 miles from Brisbane by coach or steamer), and also between Gympie and Maryborough, but particularly on the Imbil Creek. *Close time* in Queensland is from 1st February to 30th April, but does not include Snipe or the Marsupalia.

AUSTRALASIA.—NEW ZEALAND.

Game in New Zealand is confined to Bird, Rabbit, Hare and Wild-pig shooting; and shooting is not plentiful. Of Ducks the chief varieties are Blue Mountain and Black; Grey, Black, and Brown Teal; Spoonbills. There are also Black Swans, Wild Grey Geese, Dotterel, Curlew, Tiu, Native Pigeons and Quail. The Acclimatisation Society have successfully introduced Pheasants and Hares. The Pheasants may be shot in May only; the licenses cost £2 10s. They are most plentiful in Canterbury (S.I.) and Auckland (N.I.). Hares are only used for coursing, which is considerably practised.

In Nelson and Auckland Quail are plentiful. The rivers and lakes afford the best sport at Water-fowl, &c. There is likewise good shooting all along the sea-board. All important places on the coast are in direct

communication by means of the U.S.S. Co. steamers, which circumnavigate both islands. A very good district is the McKenzie country (S.I.), a day's drive from Timaru. Besides Wild-fowls, there are plenty of Rabbits and Wild-pigs, the latter hunted by dogs.

There is good-fishing on both islands, and in a few years New Zealand will be well stocked with all kinds of small game, and good sport readily obtained. No licence is required to carry guns. Ammunition, &c., can be obtained in most of the towns. Rifles are completely useless, a good 10- or 12-bore gun, full-choked, being best adapted for general New Zealand shooting. The *close season* is from 1st of August to 31st of March.

In Tasmania the game is similar to that of Victoria, with the addition of a pugnacious marsupial known as the "Tasmanian Devil" (*Thylacinus cynocephalus*). This animal is renowned for its ferocity and dogged stupidity, and is about the same size as the Common Grey Badger. The best districts for game are in Lincoln, Westmoreland, Cumberland and Wellington Counties. The *Thylacin* is only to be found in the high, uncultivated districts. King's, Flinder's, Barren and other Islands of the Hunter and Furneaux groups, have considerable quantities of Wild and Sea-fowl.

In *Fiji* there are no mammals, but plenty of Wild-fowl, including Geese, Curlew and the Black Duck. The Solomon Islands, New Hebrides, New Britain, New Caledonia, &c., have no animals, but are more or less stocked with Wild-fowl and Pigeons. In most of the islands between 160° and 180° east longitude, cruisers and missionaries have reported finding large numbers of Sea-fowl, and many are well stocked with Sandpipers, Curlew, Terns, and several varieties of Ducks. There are no mammals indigenous to the islands, but in some there are many Wild-pigs and large Lizards, which serve the natives for food.

In *Papua* or *New Guinea* the animals are the same as found in Australia, but there are not so many varieties of the Kangaroo family, and they are smaller than those of southern Australia. Dugong are found in the Gulf of Papua, and Crocodiles and other large reptiles are common upon the island. The climate is most deadly, and there has no settlement yet been effected.

THE EAST INDIES.—*Java* is a very good hunting-ground for those who are prepared to rough it, and who can live upon an East Indian

diet. In Java are to be found Tigers, Leopards, Wild Cattle, Buffalo, Rhinoceri, Wild Boars, Rabbits, Pea-fowl, Partridges, Snipe, Jungle-fowl, Rice Birds and Wild-fowl, besides other birds, and small animals of great interest to the naturalist.

Near Batavia sport may be had by taking rail to Buytenzorg (fifty miles). A few Tigers may be had in the district, and numbers of Wild-boars, Snipe, and probable chances at Pea and Jungle-fowl, and the Javanese Hare or Rabbit. The best sport is obtained, however, in the Kedirie or the adjoining country of Madioen; both these places are reached from Sourabaya by coach. A railway from Batavia running through this district is, or will shortly be, opened. Khedirie is the best district in the island for Tigers, Leopards and Buffalo. Madioen is especially famous for Boar and Wild Oxen (*Bos sondaicus*), but in both districts the sport is very fine. The Javanese Rhinoceros (*R. sondaicus*) is smaller than that of Sumatra, is longer in the leg, has but one horn, and is easily domesticated; they are rather scarce on the island, and seldom take to water. Of Deer there are six species in Java; the "Kidang" and "Manjavgan" are the most plentiful. Wild-boars are so plentiful as to be a pest, and a continual war is waged against them by the sugar-planters. Of Tigers there are two kinds, the common Indian Tiger, and a smaller variety termed by the Javanese "Machan kichil." There is also the common Leopard and the Black Java Panther—the terror of the natives. Of birds, Snipe are the most plentiful; and besides those already mentioned, Pigeons and Quail are numerous. For travelling and shooting the best months are between September and February, but the high-land of the interior is sufficiently temperate to permit travelling at any time of the year. The climate is exceptionally healthy for the East, but the swamps in the north, near Batavia, should be avoided. It will be necessary to take outfit from England or India, especially ammunition; clothing same as for Europe; and if camping-out is contemplated, thick blankets will be necessary. We are not aware of any game-laws existing in any of the Dutch Indies; but if sport is wanted, care must be taken not to offend the Dutch or the native chiefs; the latter always expect deference, and are extremely dignified.

Borneo.—In this island are to be found many animals and birds interesting to naturalists, and several considered by sportsmen the *crême*

de la crême of sport, viz., Elephants, Rhinoceri and Buffalo; these animals inhabit the north-eastern and central districts. Deer and Wild-boar are plentiful. Black Leopards, Panthers (*Felis macrocelis*) Golden Tiger Cats, Sun Bears (*Ursus Malayanus*), and another species (*U. codrys-pilus*), and Ourang-outangs are occasionally met with. There is the Argus and other varieties of the Pheasant, Jungle-fowl, Quail, Snipe and many other birds. The Dutch say there are Tapirs in the island, but this has never been authenticated; there is dispute also with reference to Buffalo, the Dutch contending that it exists; Englishmen have seen the spoor, but have never shot one, although numbers of Wild Oxen (*Bos sondaicus*) have been shot. The Buffalo is known in Borneo as the "Lissang," the Wild Oxen as "Benting."

The Deer, Malayan Sambur, Spotted Deer (Muntjac") and Mouse Deer are general over the island. Comparatively little shooting is to be had near Sarawak or Bruni, excursions having to be made into the interior to get large game. The readiest way is to take a steam-launch or cutter, or to charter a "prahu" and run up some of the larger rivers; the Koti and Minna Rivers run through Rhinoceros and Elephant ground. The district of Sabak is known to be overstocked with Wild-boars, and to have large quantities of other game, and, doubtless game is plentiful throughout the interior, but at present little is known for certain respecting the high districts near the centre, or the south-east coast.

Dogs are necessary to success in Boar-hunting, and care will have to be taken that they do not fall into the jaws of the many Crocodiles which swarm in most of the rivers. Leopards may be driven, but the Elephants and Oxen have to be stalked, and Rhinoceri waited for. The climate is healthy; very little can be obtained in the way of food at many of the villages, the sportsman must therefore, in some measure, depend upon his gun to supply his party, and it is hardly necessary to say that everything in the way of guns, ammunition, and camping requisites must be taken.

SUMATRA.—The game in this island is, generally speaking, difficult to get at. Elephants are to be found, but not plentiful. A two-horned Rhinoceros (*R. Sumatrensis*) is fairly plentiful, and the Javanese one-horned variety is also said to inhabit some of the forests in the west. The Malay Tapir, the Common Tiger, the Black Leopard (*F. melas*), the Balu Leopard, the Clouded Tiger, Rare Leopard or Panther (*F. macrocelis*) are, except the

last-named, frequently met with. The Wild Oxen, Black Deer (*C. hippelaphus*), Sambur, Spotted Deer, Antelope, (*Capricornis Sumatrensis*) are to be found in the hill-forests. Other animals less frequently met with are the Malay Sunbear, Flat-headed Lynx, Golden Tiger-cat, Ourang-outang, and *Simia Moria*. Small Monkeys and Squirrels of many kinds, some most curious, are very numerous. There are several kinds of Pheasants, also Snipe, Wild-fowl, and numerous fancy birds. Outfit and necessaries must be taken, and the climate will be found inferior to that of Borneo or Java.

In the *Celebes* Wild Cattle and Deer are said to be fairly numerous. Birds are very numerous, and of great variety, In the *Sooloo* Group, Deer and Wild Boar-hunting are the chief amusements. Mindanao has also Deer and Wild Boars in large numbers. The principal attraction of the Moluccas, and other islands in the Banda and Arafura Seas, are the Birds of Paradise, and other birds of gorgeous plumage, of interest to the collector or naturalist, but not in any sense game-birds. Neither on any of these smaller islands is there anything to induce the sportsman to leave the islands farther north.

THE WEST INDIES.

Shooting in the West India islands may be looked upon as *nil.* Of all the Caribbean or Windward islands only one lays any pretension to possessing game. This is Barbuda ; it has herds of Fallow Deer, amounting to 3,000 head, and plenty of Guinea-fowl and Sea-fowl. Pigeons are common to all the islands ; and in September Plover pass the various islands in large numbers. This constitutes the only shooting of Barbadoes, St. Vincent and Antigua. Trinidad has better sport : Wild-pigs, Guinea-fowl, Pigeons, &c., but no Deer.

In Porto Rico, San Domingo and the Bahamas, the shooting is also next to nothing. It is slightly better in Jamaica, Cuba and Isla de Piños, but there is no large game. Sea-fowl in great variety amongst the West Indies generally, and the shooting is worth taking out a gun for, providing such sport alone is expected.

ENGLISH ISLANDS.

On the Orkney and Shetland Islands, and also upon St. Kilda, there is very good Wild-fowl shooting. In the Channel Islands are Red-legged

Partridges, a few Rabbits, Quail, Woodcock, and very fair shore-shooting and punting.

At the Falkland Islands there is very good sport. Wild Cattle and Wild Horses are very numerous; Pigs are not so plentiful; Rabbits are so numerous as to be a pest. Of Wild-fowl there are Swans, Geese, Ducks, Teal, Shags, Rockhoppers, Sandpipers, Gulls, Cape-hens, White Birds, Albatrosses, Owls, Common Hawks, Penguins and Snipe.

ST. HELENA AND ASCENSION.

In the former the Indian Partridge and Ringed Pheasant have been introduced, and are preserved for shooting; the former are very wild. The season for the Chukar Partridge extends over three months; for the Pheasant, six weeks in the autumn. License is necessary. There are a few Wild Goats, a kind of Rock Pigeon, and a species of Plover called the "Wire Bird." Wild-fowl are fairly numerous, but difficult to get at.

Ascension is nothing but an Admiralty station, and the only shooting is at Sea-fowl.

CYPRUS.

Cyprus, before becoming an English possession, abounded with game. It is reported that a large herd of Deer and Mouflons (*Ovis musimon*) inhabit the island, but this has not been corroborated, although *several* Mouflons have been seen by English visitors; a few Deer have also been observed in the distance. There are also said to be Wild Pigs, but none have yet been killed by Englishmen.

Hares, about the size of a good English Jack Rabbit, are plentiful all over the island, and these appear to be the only animals worth shooting. In birds, Cyprus is very rich. Cranes, Grey and Red-legged Partridge, Francolin Duck, Coot, Quail, Plover, Woodcock and Snipe are to be found nearly all over the island. The northern state, however, is said to be the best for sport.

The best district near Larnaka is Oros Stravo, a five hours' mule ride; there is also good ground at Ronika, thirty miles to the north of Larnaka.

For Snipe, Ducks and Wild-fowl, the marshes on the promontory of

Aksoteri are about the best; a very good one is at Limasol. There was a good marsh near Famagosta, but it has lately been well shot over. Coot are far more numerous than Duck, but occasionally several hundreds of the latter may be seen on one lake without a Coot amongst them; and a collapsible boat taken over to the north or north-eastern sides of the island should amply repay the trouble.

Francolin are not plentiful on the southern side; the best ground is between Paphos and Kulia. Snipe and Water-fowl may be had in nearly all the marshes, including those near Baffa, Morpha, Salamis and Trikomo, but for hill-shooting the north-eastern peninsula, from Cape Elea to Cape Andrea, should afford the best shooting.

There is no shooting in Cyprus to attract sportsmen from England, or deter them from longer voyages in quest of game, but those who determine to reside upon the Island, should furnish themselves with guns and ammunition, since shooting is to be obtained equal to that ordinarily met with in Western Europe.

CUSTOMS DUTIES ON SPORTING GOODS.

	Amount Charged on				
Country.	Guns or Rifles.	Revolvers.	Gunpowder.	Shot.	Cartridges.
Europe—					
Austria ..	30 Fl. per 100 kilos	30 Fl. per 100 kilos.	52 Fl. 50 kr. per 100 kilos.	d. per lb.	About 5s. per cwt.
Belgium ...	Free by permit.	Free by permit.	6s. per cwt.	10 % ad val.	By permit.
Denmark ...	Free.	Free.	$1\frac{1}{4}$d. per lb.	$1\frac{1}{4}$d. per lb.	$1\frac{1}{4}$d. per lb.
France... ...	2 f. 40 c. per kilo	As guns.	Prohibited.	3 c. per kilo.	Prohibited.
Germany ...	60 pfg. per kilo	As guns.	Free.	6 mks. per 100 kilo.	10 % ad val.
Greece... ...	6 drachma each.	10 % ad val.	12s. 9d. per cwt.	11s. 6d. per cwt.	Free.
Holland ...	5 % ad val.	5 % ad val.	5 % ad val.	Free.	5 % ad val.
Italy	6 Lira each.	3 Lira each.	61s. per cwt.	5 Lira per 100 kilos.	61s. per cwt.
Portugal ...	30 % ad val.	30 % ad val.	200 Reis per kilo	30 R. per kilo.	300 R. per kilo.
Russia	18 Rbl. per lb.*	18 Rbl. per lb.	Prohibited.	80 cop. per lb.	Prohibited.
Scandinavia	See notes.	below.			
Spain	About 1s. 6d. per lb.	See below.	See below.	$7\frac{3}{4}$d. per cwt.	30s. 6d. per cwt.
Switzerland...	8 frcs. per cwt.	8 frcs. per cwt.	Prohibited.	$7\frac{1}{4}$d. per cwt.	15 frcs. per cwt.
Turkey ...	Free.	Prohibited.	Nom. prohibtd.	2s. per cwt.	Nom. prohibtd.

* The Russian pood equals 60 lbs

CUSTOMS DUTIES—(*Continued*).

Country.	Amount Charged on				
	Guns or Rifles.	Revolvers.	Gunpowder.	Shot.	Cartridges.
Asia—					
China	About 10 %.	Prohibited.	About 15 %.	Free.	Free.
Japan	About 10 %.	About 10 %.	About 15 %.	5 % ad val.	10 % ad val.
Indies	About 7 %.	About 7 %.	About 10 %.	Free.	Free.
Ceylon... ...	10s. each.	6s. each.	4d. per lb.	1s. per cwt.	As shot.

India:—

	R.	A.
Firearms other than Pistols, for each ...	50	0
Barrels for the same, whether single or double, for each	30	0
Pistols, for each ...	15	0
Barrels for the same, whether single or double, for each	10	0
Pistols, for each chamber	2	8
Gunpowder, per cwt.	10	0

Exception 2.—No duty in excess of 10 per cent. *ad valorem* shall be levied upon any of the said articles imported in reasonable quantity for his own private use by any person lawfully entitled to possess the same.

Officers and Superintendents of Police are allowed to pass free, whether as part of their baggage or not, a rifle or revolver each, if they are to be used for military purposes, but a *certificate is required* in each case.

In the Cape Colony a duty of 20s. a barrel upon guns and rifles, and 20 per cent. *ad valorem* additional; 10s. upon pistols and revolvers; gunpowder pays 6d. per lb.; shot 10 per cent. *ad valorem*. The duties are the same for Natal.

AUSTRALIA.

In *Victoria* guns and pistols are admitted free, but probably an alteration will soon be made. Powder pays about 3d. per lb., and shot 3s. per cwt. Gun-cases and fittings are liable to a duty of 25 per cent. *ad valorem.*

In *New South Wales* guns and pistols are also free. Gunpowder 3d. per lb.; shot 5s. per cwt.; cartridges according to quantity of powder and shot they contain; cases and munitions 10 per cent. *ad valorem.*

In *South Australia*, guns, pistols and cartridges are subject to a duty of 10 per cent. *ad valorem*; sporting-powder 3d. per lb.; shot 2s. 6d. per cwt.; other sporting goods 10 per cent. *ad valorem.*

In *Queensland*, guns, pistols and sporting accessories pay 5 per cent. *ad valorem* duties; gunpowder 2d. per lb.; shot 2s. per cwt.

In *New Zealand*, guns and all sporting accessories pay 16½ per cent. *ad valorem;* gunpowder 6d. per lb.; shot 10s. per cwt.; percussion caps 1s. per 1,000.

SOUTH AMERICA.

In *Brazil*, guns 800 reis per kilo.; single fowling-pieces 1,000 reis per quintal; gunpowder 400 reis per quintal; shot 80 reis per quintal; cartridges 30 per cent. *ad valorem.*

In the *Argentine Republic*, no charge on guns taken out by sportsmen; gunpowder and cartridges pay 35 per cent. *ad valorem;* and 40 per cent. for guns wholesale.

In *Chili*, military arms 3 dols. each; on sporting arms *ad valorem* duties of 25 per cent.; gunpowder 15 dols. per quintal, but if in flasks 35 cents per lb.; shot 6 dols. per quintal.

The above tariff will, it is expected, be revised and modified shortly.

No license to carry arms for sporting purposes is required in any of the South American States.

DUTIES FOR SCANDINAVIA.

In *Sweden*, there is a duty of 12 öre per kilo. on gunpowder, and 50 öre per kilo. on guns. No license is required for shooting in the high-lands; fine imposed for shooting near towns, and trespassers can be prosecuted.

In *Norway*, guns, gunpowder, cartridges and shot may be imported free. Foreigners must provide themselves with annual licenses, costing not less than 200 kroner (£10) or more than 400 kroner, as may be decided upon from time to time.

In *Denmark*, no license is necessary at present; but the advisability of imposing restrictions is under the consideration of the administration.

CUSTOMS REGULATIONS IN SPAIN.

Sportsmen going to Spain will save much annoyance and delay by obtaining a permit to shoot from the Spanish Consulate, cost about £1. Without this, their arms and ammunition will be stopped at the Customs; but if provided with the license no difficulty will be experienced, beyond

paying the duty of about eight or ten shillings per gun, according to weight. Revolvers are prohibited, but are usually carried secreted on the person.

WHERE TO GO FOR GAME.

For large game in Europe, Transylvania, Hungary and Roumania offer the most attractions. For Deer and feathered game, Norway, northern Sweden, the *north-west of Spain*, northern Portugal, and northern Italy and Sardinia are good regions. For Wild-fowl the coast of Holland and the Frisian Islands, the Faroe Islands, Calvados and the districts of Gironde and the Landes in south-western France, the islands on the Dalmatian and Albanian coast, the Ionian Islands and the Venetian Lagoons.

In the Mediterranean there is very fair shooting along the coast of Mogador, and the coast of Asia Minor lying between the Rivers Orontes and Doloman. These resorts are for sportsmen who have no influence with foreign nobles, and who cannot leave Europe. For those who can spare the time and means to go further afield, Java, Borneo and India offer first-class ground. There is also excellent sport to be had in the Cape Colony, in Senegambia, and on the Congo River.

In America the United States are preferable to Canada, and the best state for large and general game-shooting is Montana. Wyoming is also full of game, but has been overrun with European sportsmen the last few seasons. Nebraska and Arizona are also good territories for large game shooting.

INDEX TO FIREARMS.

S

INDEX TO SHOOTING NOTES.

Y

CASSELL & COMPANY, LIMITED, BELLE SAUVAGE WORKS, LONDON, E.C.

W. W. GREENER'S

Complete Price List

OF

GUNS, RIFLES, AMMUNITION, and ACCESSORIES.

MEDAL and SPECIAL FIRST,

PARIS, 1878.

CAPE TOWN, 1877.

SYDNEY, 1880.

FIRST AWARD AND GOLD MEDAL, MELBOURNE, 1881.

GOLD MEDALS, CLEVES, 1881; CHRISTCHURCH, N.Z., 1882.

WINNER AT THE LONDON GUN TRIALS OF 1875, 1877, 1878, 1879.

ST. MARY'S WORKS, BIRMINGHAM;
68, HAYMARKET, LONDON;
8, AVENUE DE L'OPERA, PARIS.

W. W. GREENER'S PATENT TREBLE WEDGE-FAST HAMMERLESS GUN.

THE GUN OF THE FUTURE.

No. A. Quality special best Gun, extra finish	**45 gs.**
No. 1.—Greener's Patent Treble Wedge-fast Hammerless Breech-loader, best quality	**40 gs.**
No. 2.—Ditto, first quality in every respect, but less engraving, and plainly finished	**35 gs.**
No. 3.—Ditto, moderately engraved and well finished	**30 gs.**
No. 4.—Ditto, ditto, engraved	**25 gs.**
No. 5.—Cheapest quality	**20 gs.**

16- and 20-bores at the same prices; 10-bores one guinea extra, 8-bores three guineas extra.

The above prices do not include cases.

W. W. GREENER'S PATENT TREBLE WEDGE-FAST HAMMERLESS GUN (continued).

This Gun has successfully withstood the most severe trials, over 130,000 shots having been fired from one of these guns in two years, without the action and locks being cleaned. The SAFEST, STRONGEST, AND MOST DURABLE GUN YET INVENTED.

The above Guns are usually fitted with W. W. Greener's side safety, the simplest and most reliable. With the W. R. automatic safety, one guinea extra. With Greener's patent automatic tumbler and trigger-bolting safety, one guinea extra.

W. W. GREENER'S SELF-ACTING HAMMERLESS GUN.

We have made a large number of these ejecting guns; they have been well tried in every weather, and have given complete satisfaction. We have confidence in recommending them.

PRICES FOR 12-BORE:—

No. A.	Quality, "Self-acting" Gun	**50 gs.**
No. 1.	,, ,, engraved	**45 gs.**
No. 2.	,, Plain Finish, not engraved	**40 gs.**

W. W. GREENER'S HEAVY FAR-KILLING DUCK GUNS.

These Guns are all full choke-bored, and will kill at 140 yards. All are tested with heavy charges and large shot, and the shooting specially regulated for the use of the same.

The double-grip action for the lower, and the Treble Wedge-fast Breech-Action for the higher grades are used, unless ordered to the contrary. They are all chambered and regulated for the solid brass-drawn cartridges; but paper cases may also be used if preferred. The 10-bores are specially bored for brass cases, and with large shot at long ranges give great penetration and good patterns.

PRICES:

SINGLE GUNS WITH HAMMER.

8-bore, with Double-grip Breech-Action	**15 gs.** to **25 gs.**
8-bore, with Treble Wedge-fast Breech-Action	**20 gs.** to **40 gs.**
4-bore, with Double-grip Breech-Action	**20 gs.** to **30 gs.**
4-bore, with Treble Wedge-fast Breech-Action	**25 gs.** to **45 gs.**

DOUBLE GUNS WITH HAMMERS.

8-bore, with Double-grip Breech-Action	**20 gs.** to **30 gs.**
8-bore, with Treble Wedge-fast Breech-Action	**25 gs.** to **40 gs.**
4-bore, with Double-grip Breech-Action	**30 gs.** to **50 gs.**
4-bore, with Treble Wedge-fast Breech-Action	**40 gs.** to **55 gs.**

HAMMERLESS FAR-KILLING GUNS.

8-bore, Single Barrel, with our Treble Wedge-fast Action			.. ..	**25 gs.** to **45 gs.**
4-bore, ditto	ditto	ditto	... ...	**30 gs.** to **50 gs.**
8-bore, Double Barrel	ditto	ditto	... ...	**27 gs.** to **46 gs.**
4-bore ditto	ditto	ditto	... ...	**40 gs.** to **50 gs.**

W. W. GREENER'S PATENT TREBLE WEDGE-FAST GUN.

FITTED WITH HIS IMPROVED LOW HAMMERS.

PRICES.

No. A.	Quality, special best Gun, with extra finish	**45 gs.**
No. 1.	—Patent Treble Wedge-fast Breech-loader, first quality, 12-bore, without Case ...	**40 gs.**
No. 2.	—Ditto, ditto, but with or without engraving	**35 gs.**
No. 3.	—Ditto, second quality, ditto	**30 gs.**
No. 4.	—Ditto ditto	**25 gs.**
No. 5.	—Ditto ditto	**20 gs.**
No. FK.	Quality, made in American style only	**16 gs.**

16- and 20-bores same price as 12-bores; 10-bores one guinea extra, 8-bores three guineas extra.

We make, to order only, a Gun highly ornamented and inlaid with gold, which we style our exhibition quality, five to twenty guineas extra. We invented the cross-bolt as an improvement on the Westley Richards' plan. This cross-bolt holds the barrels down in position; at the same time it wedges the standing breech to the ends of the barrels and against the base of the cartridges, and effectually secures the barrels at the top of the standing breech, which prevents gaping at the joint at the moment of firing. After repeated experiments, extending over many years, we have proved that the cross-bolt at the top of the standing breech is the very best that can be applied to the drop-down or Lefaucheux principle. It will securely stand double the charge that can be fired from the shoulder; the barrels would burst before the action could give way.

W. W. Greener has so improved the system of Choke-boring that he is now prepared to bore guns to make an average pattern :—200 to 240 with 1⅛ oz. No. 6 shot, 305 pellets to the 1⅛ oz.; 230 to 260 with 1¼ oz. No. 6, 340 pellets to the 1¼ oz. 10-bore the same, with 1¾ oz., with 1½ oz., 280 pellets.

All these guns will shoot even and regular patterns, and are free from that patchy and wild shooting which frequently causes the loss of a match, and are especially adapted for Pigeon shooting.

PIGEON SHOOTING GUNS, A SPECIALITY.

MISCELLANEOUS.

Portable Decoy Duck, **12s.** each.

Anti-recoil Heel-plates, **1 gu.** extra.

India-rubber Shoe, for lengthening gun-stocks, **7s. 6d.** extra.

Punt Guns built to order.

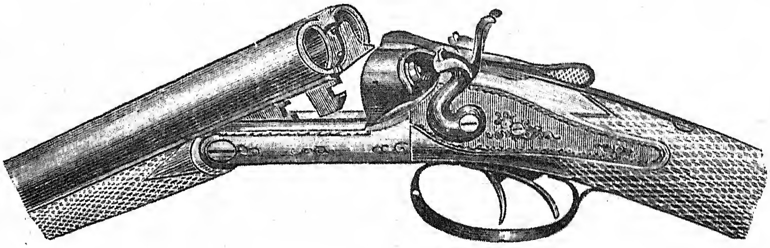
Breech-loaders ... ... from **£52 10 0** to **£63 0 0**

Punt Gun Cartridge Cases, 1½ in. bore, **15s.** per doz.

Solid Brass-drawn Cases, 1½ in. and 1¾ in. bore (these can be used a great many times), **12s. 6d.** each.

Solid Brass-drawn Cases, 1 in. or 1¼ in. bore, **7s. 6d.** each.

TOP-LEVER SNAP-ACTION GUNS.



No. 6.—Top Lever Double Bolt, Re-bounding Locks, full or modified Choke-bore, engraved and fitted with low Hammers, either Bar or Back Action ... ... **15 gs.**

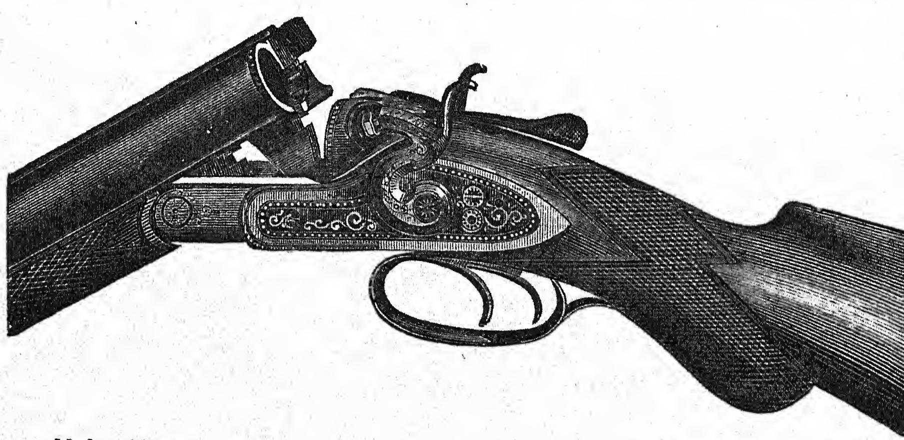
No. 7.—Ditto, ditto, modified Choke ... ... **12 gs.**

No. 8.—Ditto, ditto, with Back Action Locks ... . **10 gs.**

It is usual to make the latter quality with the Double-grip Action, but either can be had at the same price.

Single Barrel Guns Breech-loaders, from **8 gs.**

NEW PATTERN TOP-LEVER AMERICAN STYLE TRAP GUN.



Made with Horn Heel-plate, Patent Fore-end Bolt, Solid Strikers, Low Hammers, Through Lumps, &c. &c.

This Gun is warranted to shoot well, wear well, and handle well.

Best Gun ever offered at the price, full or modified Choke ... ... **13 gs.**

DOUBLE EXPRESS RIFLES.

		Not Engraved.
Treble Wedge-fast Hammerless Rifles, well engraved and finished	50 gs., 45 gs. ...	40 gs.
Patent Treble Wedge-fast Action, with Hammers	50 gs., 40 gs. ...	35 gs.
Double-grip Action, well finished	40 gs., 35 gs., 30 gs., and	25 gs.

360	400	450	500	577 Bore.	Barrels.
About 7	8	9	10	12 lbs Weight	26 to 28 inches.

The above are made to take the solid brass-drawn Cartridge, as sold by all gunmakers.

DOUBLE RIFLES, FOR ELEPHANT SHOOTING.

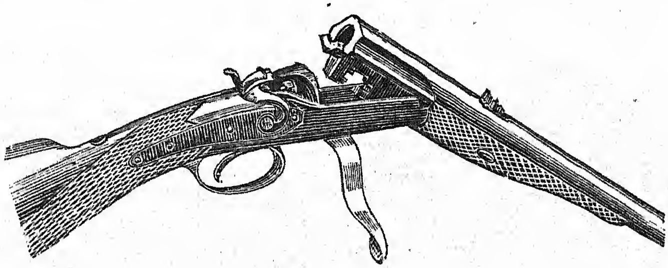
Patent Treble Wedge-fast Action Double Rifles, 4-bore	55 gs. and	50 gs.
Ditto ditto ditto 8-bore ...	50 gs., 45 gs. and	40 gs.
Ditto ditto ditto 10 or 12-bore	50gs., 40 gs., 35 gs. and	30 gs.

8-bores, 24 to 26 inches, 14 to 16 lbs. weight;
4-bores, 22 to 24 inches, 16 to 20 lbs.

Single Rifles, with Double-grip Action, 8-bore	from	20 gs.
Ditto ditto ditto 4-bore	from	25 gs.

8-bore from 11 to 15 lbs.; 4-bore from 15 to 18 lbs.

BREECH-LOADING SINGLE RIFLES, &c.



Rifle and Shot Guns, Left Barrel Rifled, Right Choke Bored, with Express or Long Range Sights, **2 gs.** more than Double Guns. Made with all Actions and all Qualities, from **12** to **45 gs.**

Metford Match Rifles, with Field Breech-Action, Orthoptic and Wind-gauge Sights, from **20 gs.**

Long Range Sporting Rifles, sighted from 100 to 1,000 yards, made especially for South African sport, with the Martini, W. R. Swinburn, and Field Hinge-Block-Action, each **10 gs.**

Superior Field Sliding-Block-Action, which admits of the Rifle being cleaned from the breech ... . **11 gs.** and **12 gs.**

We make the above for the ·577, ·450, or the No. 2 Musket Cartridge Cases.

Swedging Tools, **30s.** per set. Brass Moulds, **15s.** to **21s.**

BREECH-LOADING SINGLE RIFLES (continued).

Single Martini Sporting Express Rifles, ·450	10 gs. and 12 gs.
Ditto ditto with "Field's" Action, ·450 and ·500	12 gs. and 15 gs.

Prices on application for Soper's, Winchester, Henry, or other Sporting Rifles.

Top-lever ·360 Express Single Barrel	10 gs.
Rook Rifles, with Top-Lever Snap-Action, ·360 or ·380-bore	7 gs.
Ditto ditto with Side-Lever Snap-Action	from 3 gs. to 6 gs.
Top-Lever Snap Hammerless Rook Rifles, any bore	8 gs. and 10 gs.
Martini Rook Rifles, with Safety Bolt	from 5 gs.
Snider Vernier for Match Shooting	each 5s.
Martini ditto ditto	,, 6s.
Martini ditto, with Quadrants	,, 8s. 6d.

W. W. GREENER'S REVOLVERS.

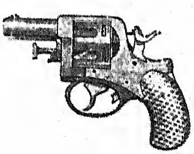
The Self-extracting Army Revolver	5 gs.
The Army Revolver, solid frame, not Extracting	3 gs.
The Irish Constabulary Revolver	2 gs.
Greener's Bull-dog Revolvers	2 gs.
Revolvers for House Protection...	1 gu.

All for ·455 or ·450 Regulation Cartridges. ·380-bore, same price.

Nickel-plated, 5s. extra.

Holsters, Belt, and Pouch for the above, 10s. 6d. and 15s. 6d.

GREENER'S BULL-DOG REVOLVER.



For the Regulation ·450 Cartridge; weighs only 18 oz.; entire length, 7 in.; best workmanship; thoroughly reliable, at 42s. each. Constabulary pattern, longer Barrel, heavier Pistol, same price. The smallest English Pistol made is the 230 rim fire, weighing 7 oz., about 6 in. long. Price 45s.

Saloon Pistols, from 21s.

GUN CASES, &c.

CASES COMPLETE WITH LOADING AND CLEANING APPARATUS.

No. 1.—First Quality, Leather Case, with Slide Lock, and Apparatus, complete... ...	7 gs.
No. 2.—Second quality, complete	6 gs.
No. 3.—Leather Case, complete, with Apparatus	5 gs.
No. 4.—Best Tanned Canvas Case, complete...	4 gs.
No. 5.—Tanned Canvas, Baize lining	3 gs.

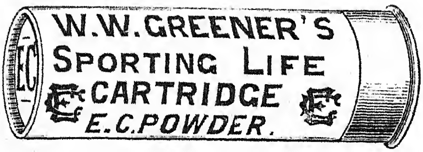
The above Cases are constructed to hold the Gun and Apparatus only. If required with Tray, to hold Cartridges or a pair of Guns, they must be specially ordered. Same cases, without implements, half price. We also sell a special light canvas case, price 1 guinea.

Light Leg of Mutton Case, to hold Gun only, best Leather	3 gs.
Ditto, second quality	2 gs.
Ordinary Canvas Cartridge Bags, bound with Leather	7s. 6d.
Superior ditto	10s. 6d.
Gun Covers, Canvas, bound with Leather	12s. 6d. to 25s.
Check Waterproof Covers...	7s. 6d.
Game Bags, each	from 25s.

CARTRIDGE MAGAZINES.

Solid Leather, with Sling for Shoulder (to hold 100 Cartridges)	**35s.**
Ditto (to hold 200 Cartridges)	**2 gs.**
Ditto (to hold 300 Cartridges)	**$2\frac{1}{2}$ gs.**
Ditto (to hold 500 Cartridges), with Spring-lock	**3 gs.**

W. W. GREENER'S CARTRIDGE LIST.



We are now supplying Cartridges, loaded with our Prize Powder and Chilled Shot, at the following prices, being of superior quality, and loaded with powder of an expensive kind, same as used by the great pigeon shots who have distinguished themselves with our guns at the different Clubs in London and elsewhere, and at the Gun Trials of 1875 and 1878. Our No. 6 Shot contains 270 pellets to the ounce; we count 305 pellets into every Cartridge containing $1\frac{1}{8}$ ounce, by an improved machine. Such careful loading gives wonderful regularity of shooting, and has never yet been adopted by any other maker:—

	Per 100.
Green or Blue Cartridges, 3 drams powder and $1\frac{1}{8}$ oz. chilled shot, with 4 wads ...	**10s. 6d.**
Ditto, $3\frac{1}{4}$ drams powder, $1\frac{1}{8}$ oz. chilled shot	**11s. 0d.**
Ditto, $3\frac{1}{4}$ drams powder full, $1\frac{1}{4}$ oz. chilled shot, for pigeon shooting	**12s. 0d.**
Ditto, $3\frac{1}{2}$ drams powder, $1\frac{1}{4}$ oz. shot	**14s. 0d.**
Cheap Brown Cartridges, loaded with ordinary powder and shot	**8s. 6d.**

16-bores and 20-bores, **1s.** per hundred less. 10-bores charged specially according to the load required.

Any of the above charges in "Perfect" or Eley's Brass Cartridges, **6d.** per 100 extra.

"SMOKELESS" SHOT CARTRIDGES.

The "SPORTING LIFE" CARTRIDGES produced by W. W. Greener as perfect for obtaining full advantages of the "E. C." powder, perfect ignition, no residue, smokeless, little recoil, carefully weighed charges of 42 grains or less	**12s. 0d.**
If 45 or 47 grains	**12s. 6d.**

If with $1\frac{1}{4}$ oz. shot, **6d.** per 100 extra.

The above prices are applicable to best green or buff cases, charged with Schultze's Improved Granulated Powder; the latter, if in "Perfect" or "Eley's" thin brass cases, **6d.** per 100 extra. **1s.** per 100 less for any of above, if cash be sent with order. Chilled Shot, **8s. 6d.** per bag of 28 lbs.

W. W. GREENER'S CARTRIDGE LIST (continued).

	Per lb.
Greener's Prize Gunpowder, in 1 lb. tins	2s. 6d.
Ditto, in 5 lb. tins	2s. 3d.
Best Ordinary Gunpowder	2s. 0d.
Good Powder for Gamekeepers' or Farmers' use	1s. 6d.
Schultze's Gunpowder, or "E. C." Rifle or Sporting grain	7s. 6d.

SPECIAL QUOTATION FOR LARGE QUANTITIES.

	3d.	6d.	1/-	1/3	1/6	3/-	
Strong Packing Boxes, to hold	100,	200,	300,	400,	500,	1,000	Cartridges.

EMPTY CARTRIDGE CASES,

12 OR 16 GAUGE.

	Per 1,000.		
Eley's Solid Brass-drawn Thin Brass Cases	£2	5	0
"Perfect" Brass Cases	2	2	6
Green or Blue, with Sunk Letters on the Base	2	0	0
Brown, E. B. Quality	1	10	0
Green, 20-bore	2	0	0
Brown, 20-bore	1	10	0
10-bore Case, 2s. 6d. per 1,000 extra.			
8-bore (Green only), up to $3\frac{1}{4}$ inches long	4	0	0
Ditto, up to $4\frac{1}{4}$ ditto	4	10	0

CARTRIDGE CASES, SOLID BRASS-DRAWN.

4-bore, **9s.** dozen; 8-bore, **6s.** dozen; 10, 12, 16, and 20-bore, **3s.** dozen.
Caps and Anvils for ditto combined, **10s.** per m.

Brass-Drawn Cartridges for Rifles 450 or 500-bore, made to contain $4\frac{1}{2}$ to 5 drams of powder	per thousand	£5	10	0
Prepared Bullets and Lubricators for ditto	,, ...	2	5	0
Felt Wadding for 12-bore	per bag, **2s.** to	0	2	6
Waterproof Wads	per thousand	0	1	6
Pink Edge Wads	per bag	0	2	6
Ordinary Paper	per thousand	0	1	6

Felt and Card Wadding for Punt Gun Cases to order.

SPECIAL QUOTATION FOR QUANTITIES OF 5,000 AND UPWARDS.

HARPOON GUNS, price **20 gs.** each. Harpoons from **30s.** each.

Breech-loading Cannon or Signal Guns for Yachts, to take the brass-drawn case, $1\frac{3}{4}$-in. bore, made to order.

PIGEON TRAPS, best quality, as used at the Gun Clubs, price **2 gs.** each, or **7 gs.** the set of five, or **40 gs.** with Beer's pulling-apparatus and traps complete.

Single Rifles, on Martini's or Field's principle, fitted with extra barrel for shot; Rifles ·450 to ·577 interchangeable with shot barrel, 20 to 12-bore, cost **3 gs.** more than Single Rifles.

Cartridge Closers...	from	**7s. 6d.** to **21s.**
Cartridge Crimpers for Rifle Cases	,,	**7s. 6d.**
"Greener's" ditto for Brass Shot Cases	,,	**7s. 6d.** to **12s. 6d.**
Cartridge Creasers for Solid Brass-drawn Shot Cases	each ,,	**7s. 6d.** to **12s. 6d.**
Cleaning Rods, complete	,,	**5s. 6d.** to **12s. 6d.**
Pocket Cleaners ...	,,	**5s. 6d.** to **12s. 6d.**
Powder and Shot Measures	the pair	**2s. 6d.** to **10s. 6d.**
Re- and De- cappers	...	**5s. 6d.** to **10s. 6d.**
Turnscrews	...	the pair **5s. 6d.**
Extractors and Dog Whistles	each	**2s. 6d.** to **10s. 6d.**

Nipple Keys, Brushes, Oil-bottles, &c., &c.

Erskine's Loading Machines, to load 100 Cartridges at a time. Made either 20-, 16- or 12-bore	each	**4 gs.**
Game Sticks or Carriers, from	,,	**5s. 6d.** to **12s. 6d.**
Cartridge Belts, canvas and elastic, from	...	**5s. 6d.** to **12s. 6d.**
,, ,, all leather, from	...	**7s. 6d.** to **15s.**
,, ,, with metal spring holders	...	**15s.** to **21s.**
Cartridge Carriers, for 20 rounds, to hang from belt or over shoulder, from, each		**10s. 6d.** to **42s.**
Waist Belt, with waterproof canvas pockets ...		each **10s.** to **20s.**

Powder-flasks, Horns, Shot-pouches, &c. &c.

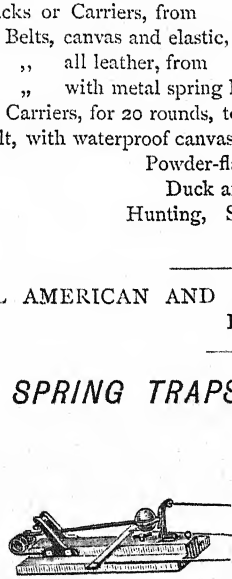
Duck and other Calls, about **7s. 6d.** each.

Hunting, Sheath, Skinning and Bowie Knives.

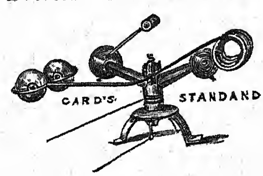
Sporting Cutlery, &c. &c.

ALL AMERICAN AND CONTINENTAL ARMS AND SPORTING GOODS PROCURED TO ORDER.

SPRING TRAPS FOR GLASS BALL SHOOTING.



Greener's Patent "Carver" Trap, **21s.**



Patent Rotating Trap, throws Balls in any direction, **42s.**

Glass Balls for ditto, **5s.** per 100 plain; **5s. 6d.** feathered, packing included.

Clay Pigeon Trap, **3½ gs.** and **4 gs.** complete.

Pigeons **12s.** per 100, in barrels of 500 and 1,000 each.

Puff Balls, superseding glass, emitting dark composition when struck, may be used many times **30s.** per 100.

CARTRIDGES FOR BALL AND CLAY PIGEON SHOOTING.

"Smokeless," **£5**, Black Powder **£4 10s.** per 1,000.

GAME AND VERMIN TRAPS.

Lion, Panther, or Tiger Traps, 12-inch jaw	each	2 gs.
Otter, Fox, or Beaver Traps, no teeth, 6-inch jaws	per dozen	2 gs.
Ditto, 9-inch jaws	... ,, ...	2½ gs.
Ditto, 12-inch jaws	... ,, ...	6 gs.

If with Spikes, £1 per dozen extra.

Ermine, Sable, and Musk Rat Traps, Double Spring	per dozen, 15s. to	19s. 0d.
Ditto, Single Spring	per dozen	12s. 0d.
Round Hawk Traps	per dozen, £1 7s. 6d. to	2 gs.
New Pattern Hawk or Heron Traps, as Illustration	each	1 gu.
Dorset Rabbit, or Vermin Traps, as Illustration, with Chains,	per dozen, from 18s. 6d. to	2½ gs.
Dog Traps	each	17s. 6d.
Rat Traps	per dozen, 14s. to	£1 5 0

All Traps of best make, and Tempered Steel Springs.

PRICES FOR REPAIRS, &c.

RE-STOCKING—Best Hammerless Gun, with Safety Bolt on Side or Top		6 gs.
Ditto Second Quality ditto ditto		5 gs.
Ditto Guns with Hammers, 30 to 40-Guinea Quality		5 gs.
Ditto Guns 20 to 25-Guinea Quality		4 gs.
Ditto Guns 15-Guinea Quality		2½ gs.

The above Prices include Blueing the Furniture and Browning the Barrels.

New Strikers and Springs	per set	£0 5 0
Converting Pin to Central Fire	3 gs. to	5 gs.

(According to the value of the work done.)

Converting Muzzle-loaders to Breech-loaders	...7 gs. to	12 gs.
Cleaning Locks, &c., of Gun	... ...	0 5 0
Stocks Altered in Bend	10s. to	1 0 0
Ditto Lengthened, by Fitting Horn Heel-plates	... ...	0 10 0
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Re-boring Barrels, Taking out Rust and Shooting	... £1 to	1 10 0
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Taking out Dents from Barrels	10s. ,,	0 15 0
Facing or Jointing up Shaky Actions	10s. ,,	1 5 0
Thoroughly doing up and Cleaning Gun, Re-chequering, Blueing, Browning Barrels, &c. &c.	each £1 ,,	1 10 0
Cleaning only	... ...	0 5 0
Blueing only	... ...	0 5 0

PRICES FOR REPAIRS, &c. (*continued*).

		£	s.	d.
New or extra Mainsprings	per pair 5s. to	0	8	0
Ditto Top-Lever Springs	... ... each	0	2	6
New Cocks	... each 5s. to	0	10	0
New Wood Fore-end Patent Bolt	... ...	1	0	0
Altering Locks to Rebound	... per pair	1	10	0
Crests, Initials, or Monograms Engraved on Thumbpiece... ...	... each 5s. to	1	0	0
Gun Cases Initialed or Named from	... each 3s. to	0	6	0

W. W. Greener, in returning thanks to Shooting men for their distinguished support during many years, begs to intimate that he has now his New Manufactory, with barrel, welding, machine-boring, fitting, and finishing shops, complete with every facility for the rapid construction of every kind of Sporting Arm. This Factory is unique, and W. W. Greener has the advantage of personally supervising the progress of the Gun in every stage, and is prepared to build, at list prices, Guns unequalled for Safety, Durability, Strength, and Closeness of Shooting, Accurate Fitting, combined with Beauty and Completeness of Finish.

TERMS.

Cash with the order, 10 per cent. discount. Cash on delivery, or within 14 days, 5 per cent. discount. Cash in one month, nett.

All accounts not paid in one month, 10 per cent. interest per annum will be charged.

Gentlemen ordering Guns from abroad will be expected to send the whole, or at least half, the cash with the order; the balance will be collected on delivery at their expense.

Address—

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THE MEASUREMENTS AS ILLUSTRATED ON PAGE 482 SHOULD **ALWAYS** BE GIVEN, UNLESS A PATTERN GUN IS SENT.

N.B.—We shoot all our Guns in the rough and when finished before they leave the Works. A Shooting Range in the Works at Birmingham, where Gentlemen can see the Guns tried before purchasing.

W. W. GREENER'S ORDER FORM.

Name..

Address..

Description of Breech Action..

No. in Price List.. *Price*..

Barrels..

Gauge.. *Weight*..

Shooting Left Barrel.., *Right Barrel*..

Stock,..........................*in long Centre*, ...*in long Bump*,

..........................*in long Toe*, ... *cast off*..........................*inch*.

Hand.. *Heel Plate*..

Bend at Bump.., *at Comb*..

Fore-end.. *Locks*..

Engraving.. *Finish*..

Terms ....

When to be finished..

Gun Case, No. ...., *Price* ....

Description ....

....

Remarks ....

....

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....

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